TECHNOLOGY DEPT.

Plastics

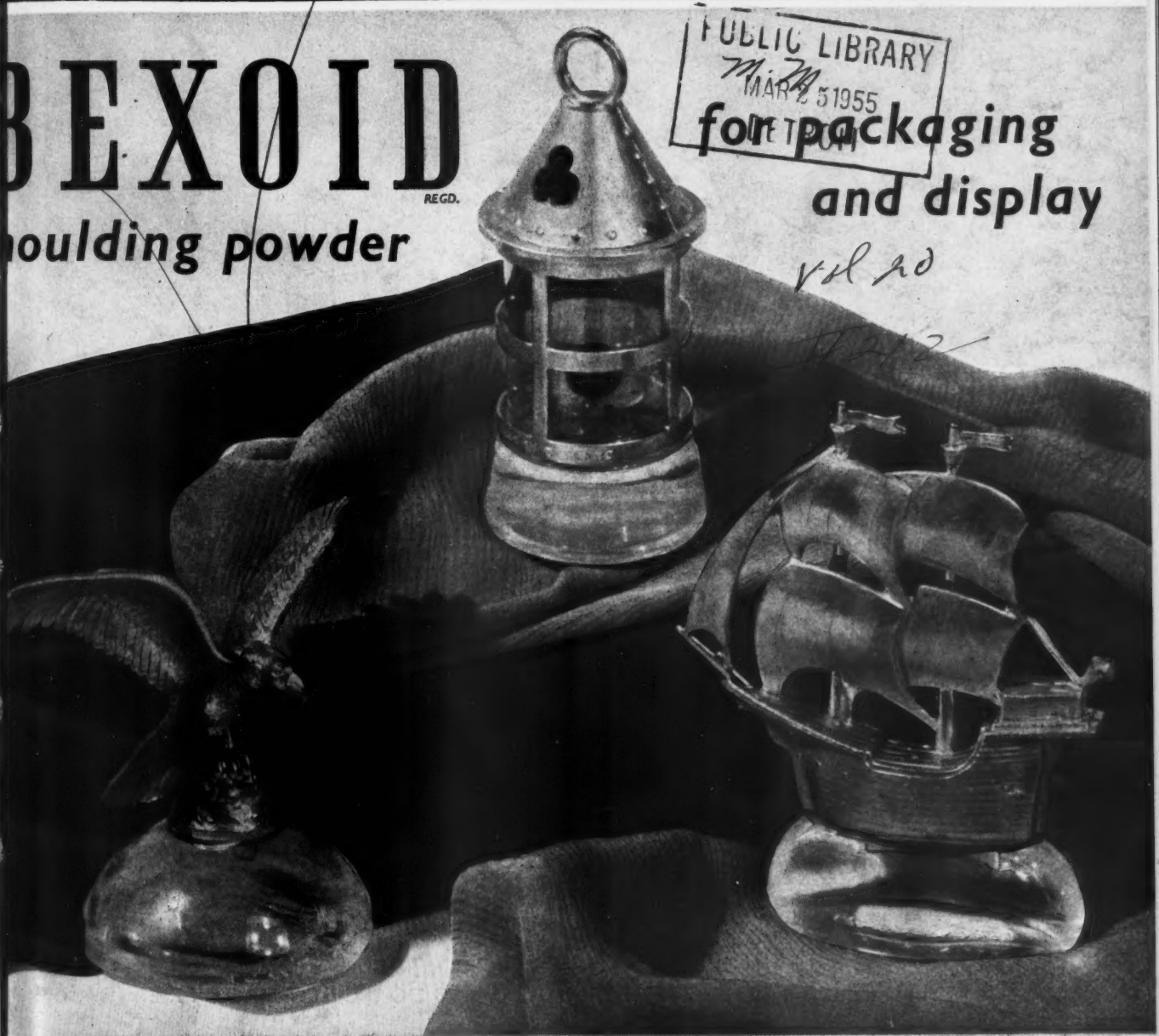
DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PUBLIC LIBRARY
MAR 2 51955

BEXOID REGD.

moulding powder

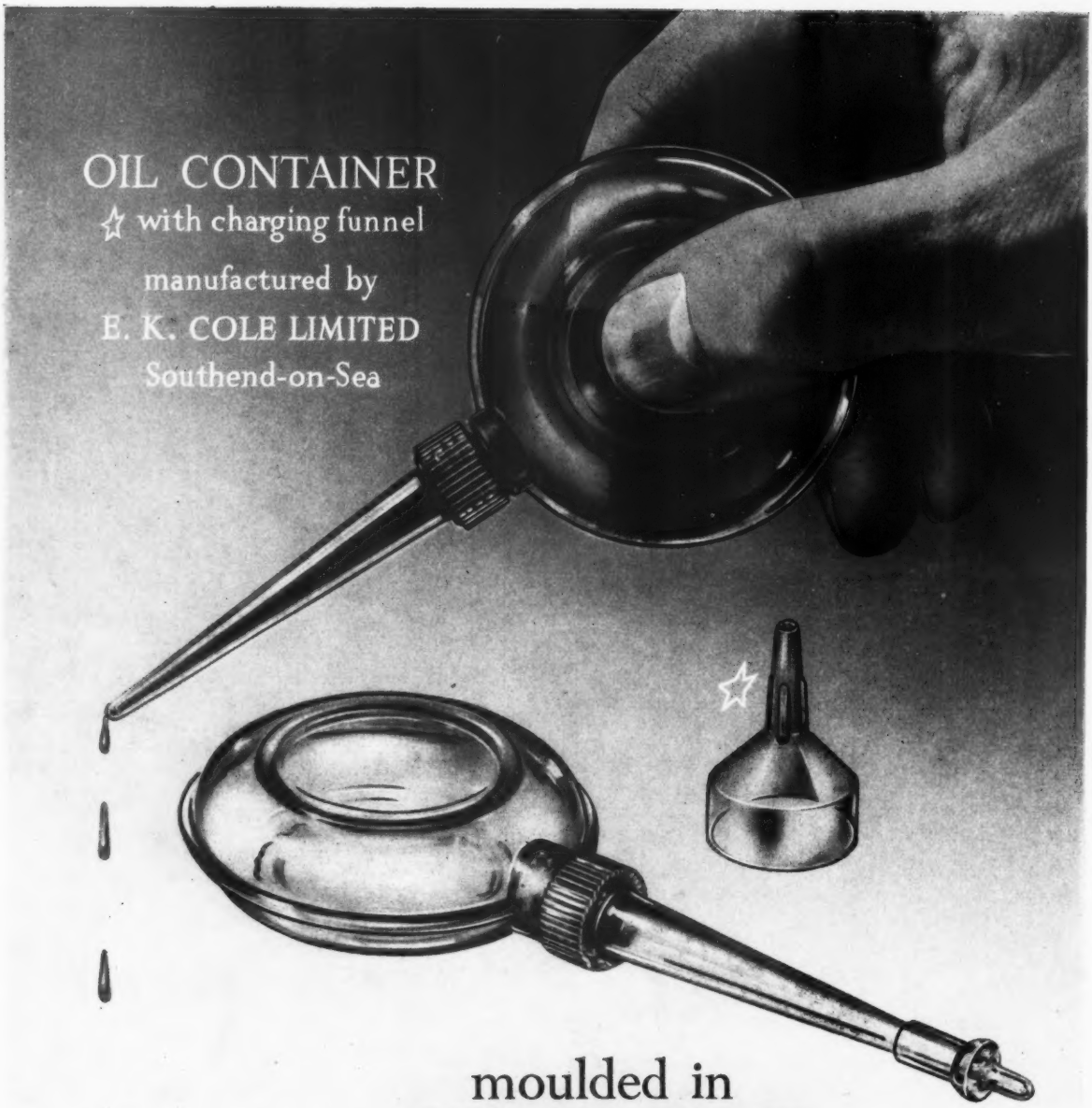
for packaging and display



Mouldings by Punfield & Barstow (Mouldings) Ltd. for International Glass Bottle Co. Ltd.

BX PLASTICS LTD. Higham Station Avenue, London, E.4.

Larkswood 5511



moulded in

Erinoid

Cellulose Acetate Powder

ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

Having trouble with Delivery Dates?

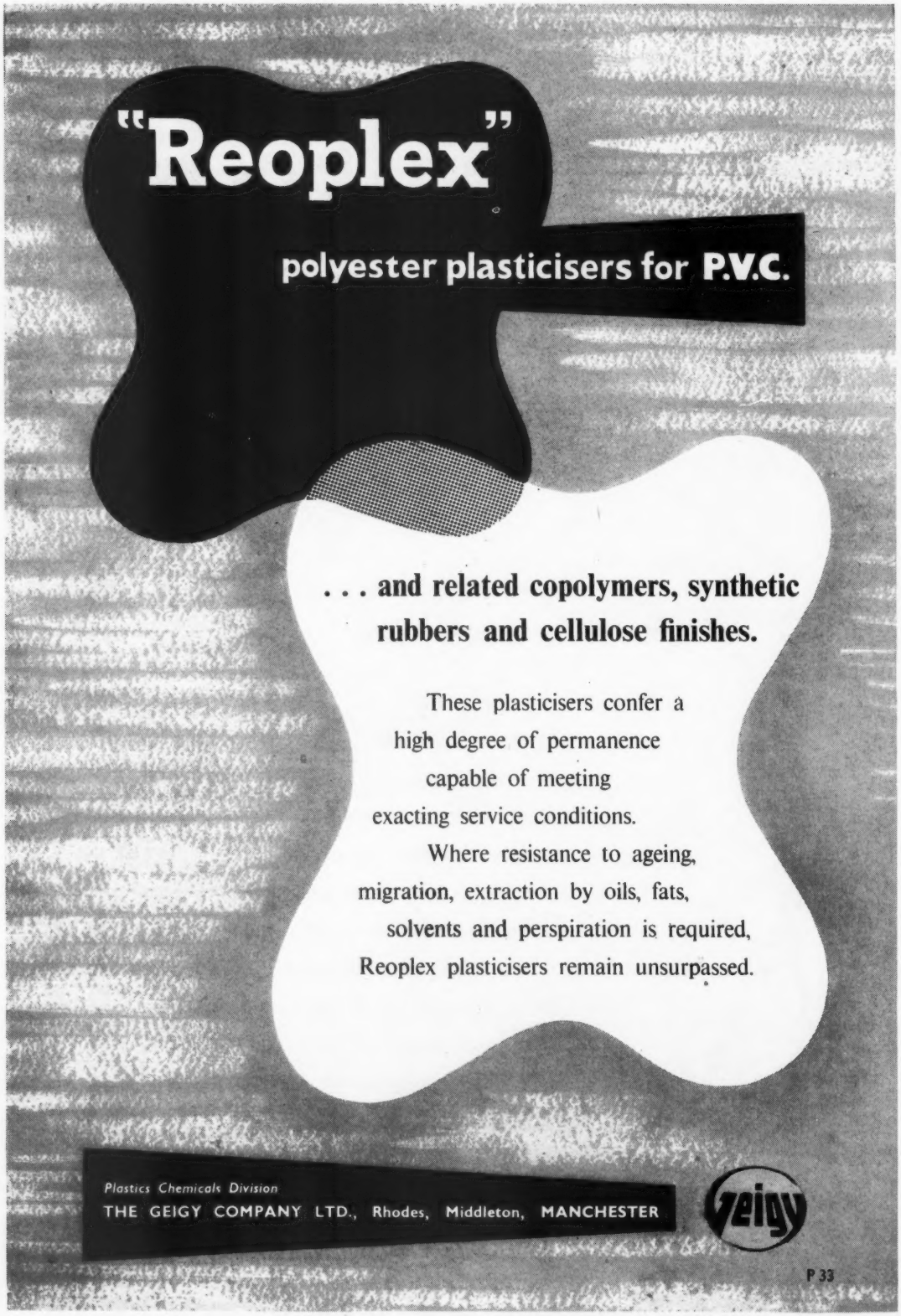
If so, we're the ones to help you. When it comes to plastics —intricately moulded with precision and accuracy—we have the best Delivery Dates in the business—*and* keep to them. As an example, we produce—to schedule—millions upon millions of Platignum Fountain Pens every year. We offer you the benefit of this experience and exceptional service. If you have a plastic problem, we are the people to help you. Send us your enquiry or tell us a convenient time to call.

we are Mentmore Plastics

MENTMORE MANUFACTURING CO. LTD., 1, BRADLEY ROAD, WOOD GREEN, LONDON, N.22. TEL.: BOWES PARK 6021/3

another **Platignum** enterprise

G&G


"Reoplex"
polyester plasticisers for P.V.C.
. . . and related copolymers, synthetic rubbers and cellulose finishes.
These plasticisers confer a high degree of permanence capable of meeting exacting service conditions.
Where resistance to ageing, migration, extraction by oils, fats, solvents and perspiration is required, Reoplex plasticisers remain unsurpassed.
Plastics Chemicals Division
THE GEIGY COMPANY LTD., Rhodes, Middleton, MANCHESTER
Geigy
P 33

CELLOMOLD

for all shapes and sizes!

Cellomold cellulose acetate moulding materials are designed to meet every conceivable injection moulding need. Their excellent flow characteristics and maximum ease of working ensure a material ideally suitable for moulding products as widely different as junction boxes and radio frames.

Mouldings made by Barclay-Stuart (Plastics) Ltd.

Ask to be put on our Mailing List (M) for regular information about BRP Moulding Materials.

BRP

Available in standard grades in a wide range of colours.

DURABLE · TOUGH AND STRONG

RIGID OR FLEXIBLE AS REQUIRED

RESISTANT TO CORROSION · ODOURLESS

TASTELESS · NON-TOXIC

PLEASANT TO TOUCH

NON-INFLAMMABLE

CELLOMOLD MATERIALS COMPLY WITH B.S. 1524

BRITISH RESIN PRODUCTS LTD

Sales & Technical Service: DEVONSHIRE HOUSE · PICCADILLY · LONDON W.1

TELEPHONE: MAYFAIR 8867 (47 LINES)

YOU CAN MOULD

NYLON

ON THE

A P M

HAND OPERATED BENCH INJECTION MOULDING MACHINE for Thermoplastics

★ THE IDEAL MACHINE FOR SMALL PRODUCTION RUNS AND FOR LABORATORY USE

Enquiries invited—

ASMIDAR PLASTIC MOULDING MACHINES LTD

5 RAMPAYNE ST., LONDON, S.W.1 TEL.: VICTORIA 5555

U·M·P

UNIVERSAL METAL PRODUCTS LIMITED
PLASTICS DIVISION SALFORD 6, LANCS

for

MOULDED PLASTICS

U·M·P

For Tubes and Plastics

Beautiful Yorkshire
No. 10

PLASTICS ELO PRODUCTS

Snow-covered Burnsall Fell
and Wharfedale

BIRKBYS LTD · LIVERSEDGE · YORKSHIRE

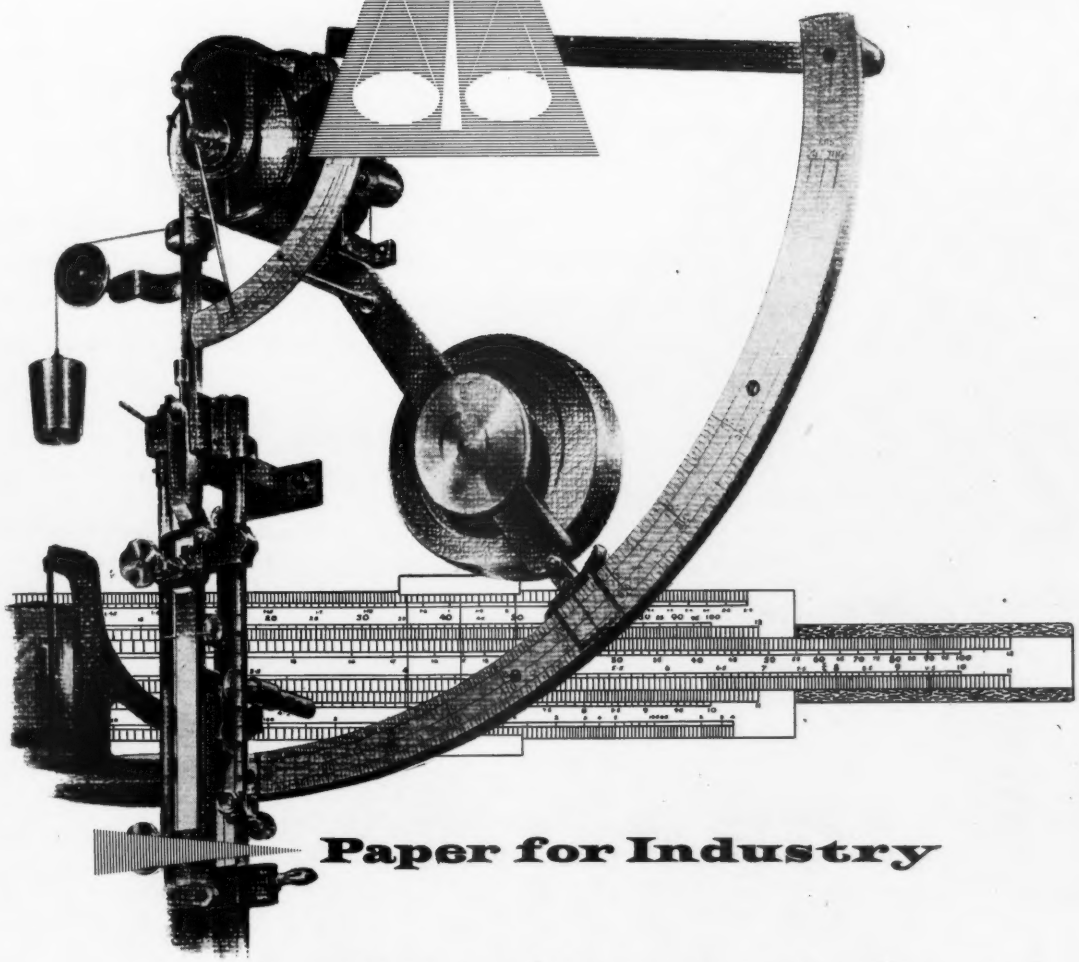
"Yorkshire Post" Photograph

"ELO" SYNTHETIC RESIN PRODUCTS

Embracing Completed Mouldings, Moulding powders, Resins, solid, powdered, or in solution, Insulating Varnishes, Cements, Lacquers, Anti-friction resins for fabric bearings, Capping cements, Filling Compounds, Sealing fluids.

London Office: 79 Baker Street, W.1.

control



Paper for Industry

Papermaking is not yet a precise science, and as a compromise between conflicting requirements in paper has often to be made, it is only by very careful scientific control that the final specification can be met. The Wiggins Teape Group is well equipped with the most up-to-date control methods and in addition has nearly 200 years of papermaking know-how and experience. New industrial uses for paper cover a large part of the Research programme of the Group.

Wiggins Teape
FINE PAPER MAKERS
LONDON
1761

THE WIGGINS TEAPE GROUP

46-58 MANSELL STREET, LONDON, E.1 ROYAL 7210

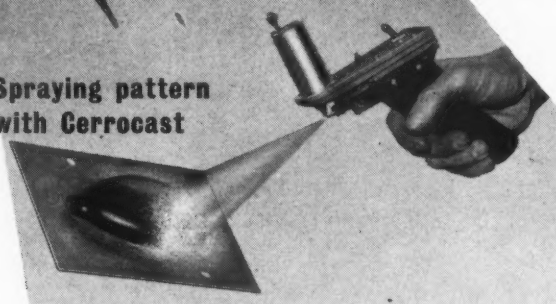
A REVOLUTION IN PLASTIC MANUFACTURE

from MASTER PATTERN to DELIVERY in 2 Days!

1 Split master pattern on match plate

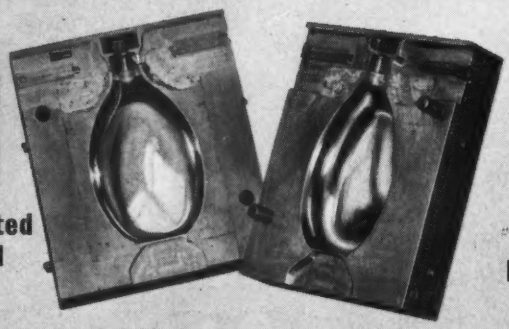
By courtesy of Messrs. Fibrenyle Limited we illustrate production of sprayed Cerrocast mould for manufacture of Polythene bottles. Manufacture of mould was completed within 1 day and 5,000 bottles delivered to customer within 2 days.

2 Spraying pattern with Cerrocast



★ *Technical advice on the selection and application of correct alloy to suit your problem available on request.*

3 Completed Mould

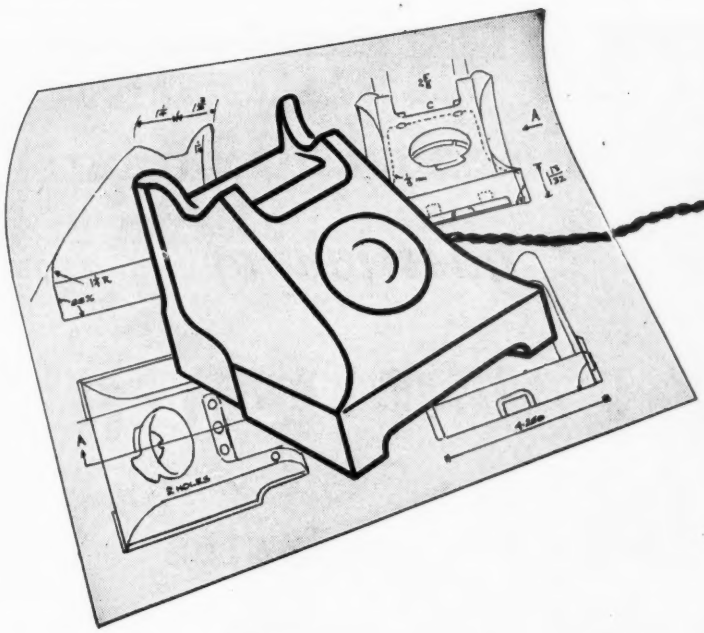


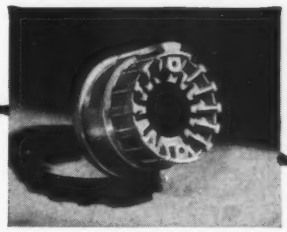
4 Moulded Polythene bottle produced

CERRO ALLOYS

LOW-TEMPERATURE-MELTING NON-SHRINKING

Mining and Chemical Products Ltd · 86 Strand London WC2 · Phone Temple Bar 6511/3

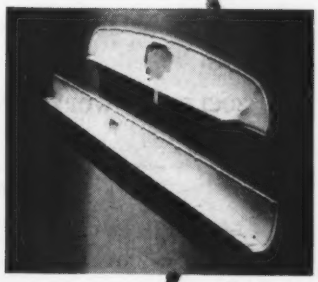




Cathode ray tube base in Nylon filled **PHENOLIC**

Washing machine agitator in **PHENOLIC**

Hair dryer casing in **UREA**



Refrigerator breaker strips in **POLYSTYRENE**

Bowl in **POLYTHENE**

Line please?

Are there amongst your products one or two lines that could possibly be improved or made more cheaply in plastics?

There's a lot of first-class equipment, an enthusiastic team of designers and engineers—and no less than 40 years' experience in this business of plastics moulding, right at the end of your telephone line. The G.E.C. will get you through . . . the number is Temple Bar 8000.

G.E.C.

PLASTICS MOULDINGS IN ALL MATERIALS FOR EVERY INDUSTRY

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

B

When it's a question of

I·N·S·U·L·A·T·I·O·N

ask for "ASHLAM" Laminates

"ASHLAM" Laminates are produced from paper, cotton fabric and fibreglass base materials. The fibreglass grades are bonded with Silicone, Melamine, Phenolic and Polyester type resins, and have very high dielectric and insulation properties.

"ASHLAM" Laminates are also available in the form of tubes with fibreglass base bonded with Polyester and Silicone resins.

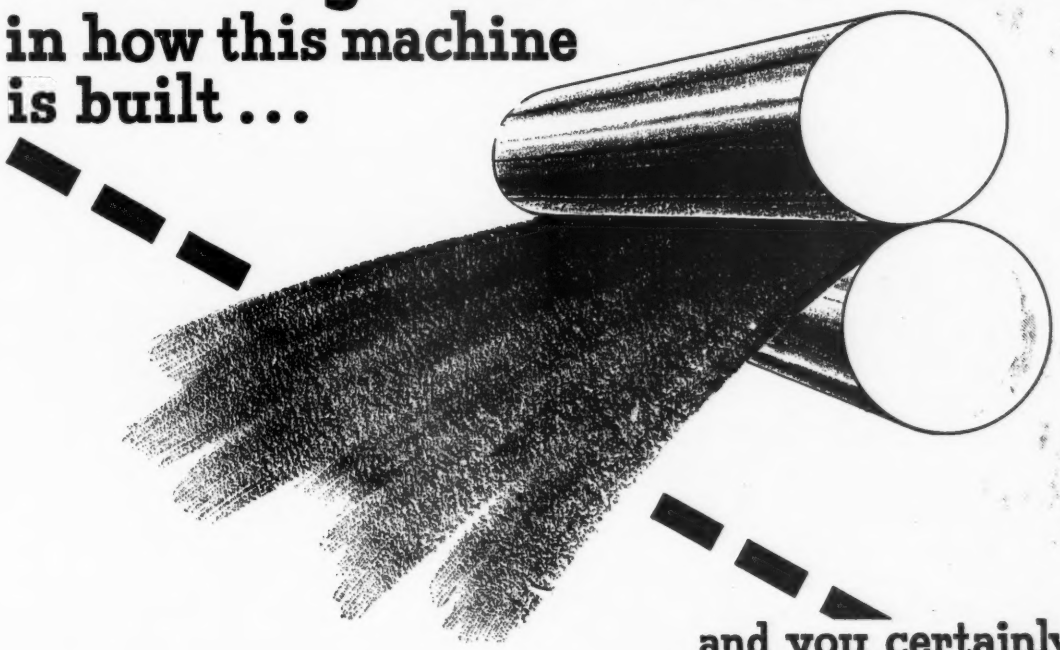
ask Ashdowns

A S H D O W N S L I M I T E D

ECCLESTON WORKS, ST. HELENS, LANCASHIRE • TELEPHONE: ST. HELENS 3206

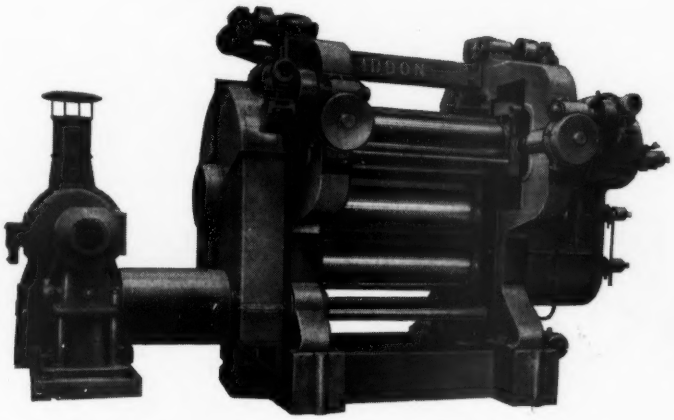
Ashdowns Limited is a subsidiary of Pilkington Brothers Limited
"ASHLAM" is the registered trade mark of Ashdowns Limited

You might be interested in how this machine is built ...



and you certainly will be interested in ....

- Its increased production
- Its safety in operation
- Precision sheets to the finest gauge
- Economy of material



Inverted "L" type Four Roll Precision Calender with Variable Speed Motor Drive, and individual motor driven screw adjustment to rolls. Rolls 24" dia.

Consultation service in relation to all rubber and plastics machinery is freely available

IDDON

BROTHERS LIMITED

TELEPHONE: LEYLAND 81258-9
TELEGRAMS: IDDON · LEYLAND

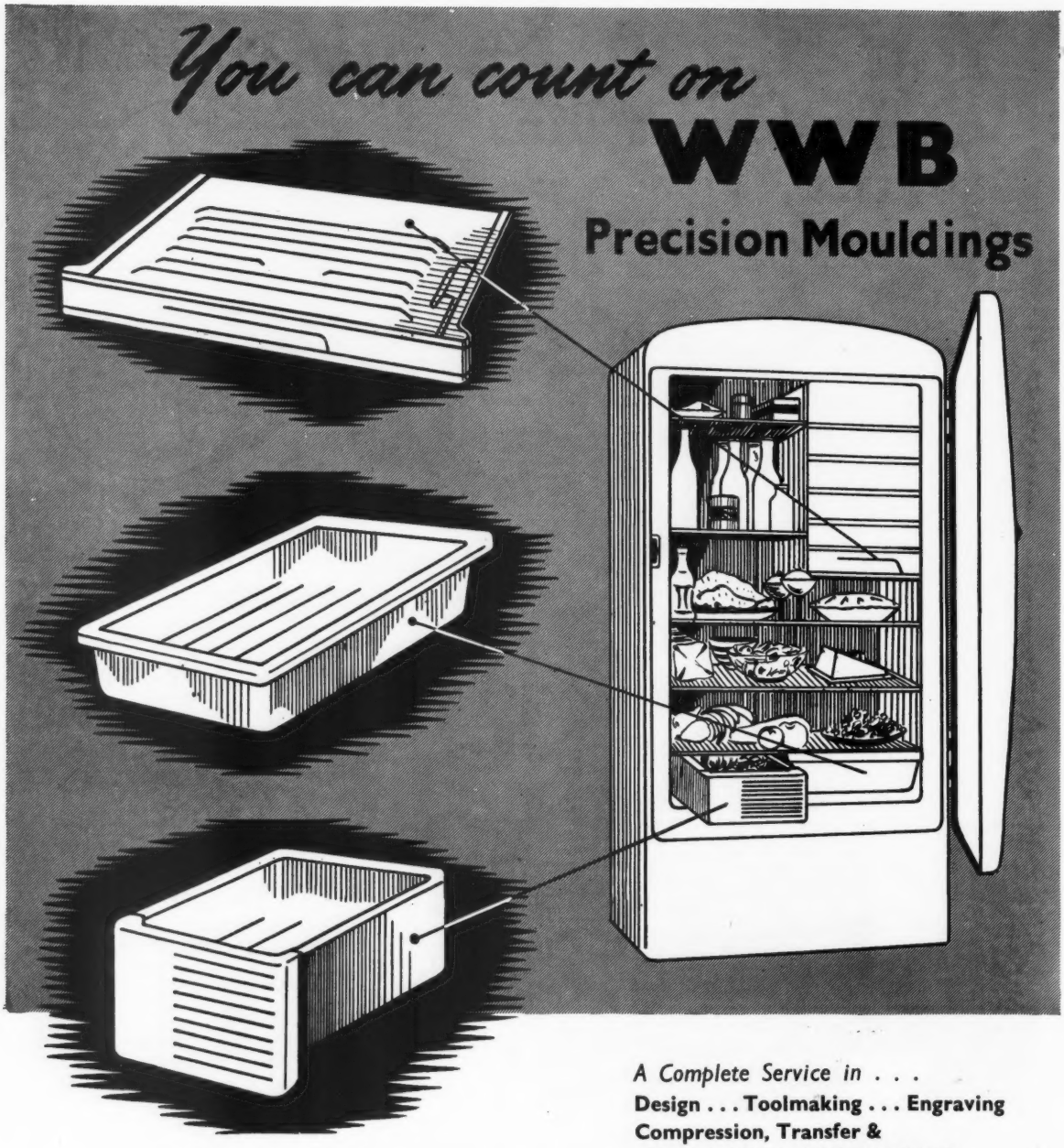
LEYLAND LANCASHIRE
ENGLAND

Manufacturers of Mixing Mills, Presses, Calenders, and Extruding Machines for Rubber and Plastics Industries

You can count on

WWB

Precision Mouldings



A Complete Service in . . .
Design . . . Toolmaking . . . Engraving
Compression, Transfer &
INJECTION MOULDING
Colour Blocking . . . Finishing
Assembly and Packaging

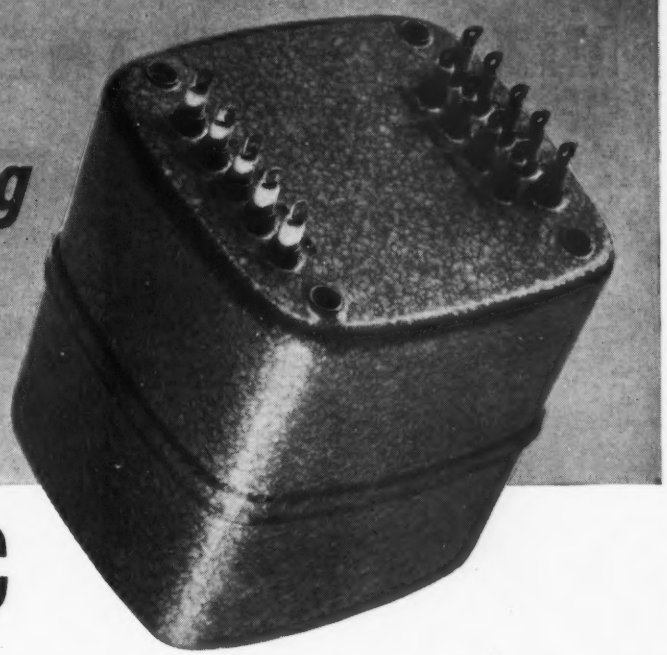
Over **30** *years' Experience*
in the Plastics Industry

BURSTEAD WORKS, KENNEL LANE,
BILLERICAY, ESSEX

Phone: **BILLERICAY 411/12** Grams: **PLASTOOL, BILLERICAY**

W. W. BALL
& SONS LIMITED

NOW outstanding OIL-RESISTANCE with Geon PVC

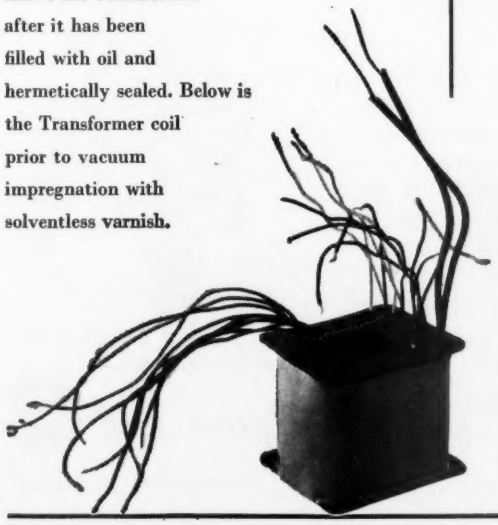


Permanoid VO Sleeving is manufactured by Permanoid Ltd.

Transformer manufactured by Associated Electronic Engineers Ltd.

This transformer has been filled with oil and hermetically sealed. All the wiring in the coil used for the transformer is covered with PERMANOID VO SLEEVING . . . which is made from specially compounded Geon PVC incorporating *Diolpate*, a plasticizer which is *non-ageing*, *non-migratory* and *non-extractable*. Although the PVC material is permanently immersed in oil at temperatures which may range from –40° to 120°C. it remains completely resistant and in perfect condition to fulfil its functions efficiently.

The illustration above shows the Transformer after it has been filled with oil and hermetically sealed. Below is the Transformer coil prior to vacuum impregnation with solventless varnish.



For more information about Geon PVC write for descriptive Booklet No. 51.

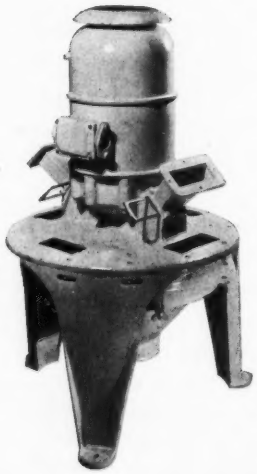
Geon
Polyvinyl Materials

British Geon Limited

Sales & Technical Service:

DEVONSHIRE HOUSE · PICCADILLY · LONDON WI TEL: MAYFAIR 8867

MIX IT WITH THE ENTOLETER



Whatever the mixture you require, there is almost certainly an Entoleter to produce a uniform and intimate blend which is beyond the scope of conventional mixers. Recent successful applications include the blending of :— Moulding compound for gramophone records · Filled phenolic compound for the manufacture of plastic dishes · Filled vinyl moulding compound for the manufacture of storage battery cases, etc. The Entoleter can produce a finished mixture at rates of up to 200 lbs./minute, and is easily incorporated as a final mixer in existing processing systems to cut mixing time, reduce costs and improve product quality. Send for leaflet IP1 describing this machine.

Entoleter Centrifugal Machines DISTRIBUTED BY **Henry Simon Ltd** SIMON ENGINEERING GROUP

STOCKPORT ENGLAND

HS127

Visit our Stand

No. 47

O.C.C.A. Exhibition

March 15—17

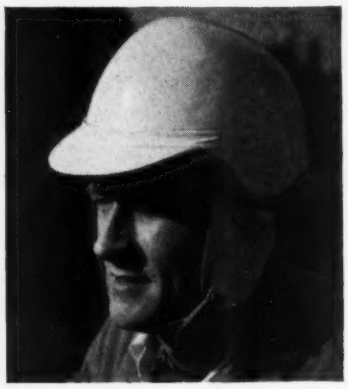
CHEMICALS DIVISION
BRITISH OXYGEN
COMPANY LIMITED

Vigo Lane, Chester-le-Street,
Co. Durham
Tel: Birtley 145

London Office:
Bridgewater House, Cleveland
Row, St. James's, London, S.W.1
Tel: Whitehall 9777

Glass protection makes the headlines and the bodylines at Earls Court

The Kangol Safety Helmet made from moulded Fibreglass to combine lightness with resilience and tremendous strength.



The showpiece of the Show—the magnificent Vincent with its weather-protective body of Fibreglass Reinforced Plastic. You can put away that space-man outfit: clean, comfortable, lounge-suit motorcycling has arrived! This easily cleaned, lightweight, non-corroding coachwork was moulded for Vincents by Necolam Ltd.

FIBREGLASS
TRADE MARK

FIBREGLASS LIMITED, RAVENHEAD, ST. HELENS, LANCS. (St. Helens 4224) *Factories at St. Helens, Lancs. and Possilpark, Glasgow*

'NESTORITE'

GRADE WOOD-FILLED UREA W.41

Filler	Woodflour
Particle size (inches)	3/32, 1/8, 3/16, 1/4 as ordered
Specific Gravity	1.45 for black. Colours higher
Bulk Factor (BS. 771)	2.2–2.7
Powder Density (BS. 771)	.50–.65
Time of Cure of Test Cup (secs.) (158°C)	38–42
Recommended flow range (BS. 771, 158°C)	4–7 secs.
Shrinkage (thou./inch) (BS. 771)	7–9 secs.
Flowability (cm.)	10-tons on 28-grams on flat disc 130°C, 7–9 cms. radius
Impact Strength (ft/lb) (BS. 1322)	0.16–0.21
Crossbreaking Strength (lbs/sq. in) (BS. 771)	9,500–12,000
Tensile Strength (lbs/sq. in) (BS. 1322)	6,000–8,000
Water absorption (mg.) (BS. 1322) (7 days)	400–500
Plastic Yield Grading (°C)	100°C
Blister Temperature (50°C per hr. rise)	140°C
Increase diam. .5" disc, room temp. humid (100 days) (thou./inch)	Negligible
Electric Strength at 90°C minute value (V/mil.)	60–90
Surface Resistivity after immersion (log 10 ohms.)	8–10
Volume Resistivity (as moulded) (log 10 ohm. cm)	10–12
Track Resistance	Very good

This is supplied in opaque colours and mottles, having good light resistance but less heat and water-resistance than phenolics. Tools should be preferably chromium-plated and run at a temperature of, say, 125°C for 10-minute, 140°C for 5-minute and 160°C for 1-minute cures. Slight modifications are available to meet specific moulding conditions or applications.

How 'Nestorite' fixed the fading Chameleon

So adroit was Charlemagne, the quick-change Chameleon, that he could fade into his background with the competence of a pickpocket at a Cup Final.

One day, when hotly pursued by that eminent Chameleonologist Lambert D. Kreppitt, he erred by crossing a Columnist in one of the left-wing Sunday newspapers which some litter-bug had discarded.

Desperately, Charlemagne endeavoured to turn his coat a shade of pink to match his surroundings. But Lambert, seizing his opportunity—and his catapult—let fly a shot of 'NESTORITE' Wood-filled Urea, thus preventing Charlemagne from fading further.

Instantly, the chameleon was exposed . . . for 'though he tried to change colour his 'NESTORITE' coating held fast. In a matter of moments he was reposing in Lambert's portable pouch.

In addition to small-size tablets for chameleon hunting, we supply larger quantities of 'NESTORITE' Wood-filled Urea for those in the Industry who require a high-quality Light Resistant Plastic Moulding Powder free from colour fading.

YOU'RE RIGHT WITH 'NESTORITE'

JAMES FERGUSON & SONS LTD.

LEA PARK WORKS, PRINCE GEORGE'S RD., MERTON ABBEY, LONDON, S.W.19

Telephone: MITCHAM 2283 (5 LINES) Telegrams: NESTORIUS SOUPHONE LONDON

A. S. HARRISON & CO. PTY. LTD.,
85, Clarence St., Sydney, Australia.
120, Wakefield St., Wellington, New Zealand.

ANDRE BERJONNEAU,
134, Avenue de Villiers, Paris 17, France.

JOSE DELCLOS MOLLERA,
Angel Baixeras, 39, Barcelona (2), Spain.

EINAR HOLMARK, 19, Gl. Kongevej,
Copenhagen V. Denmark.

C

POLYTHENE rings the bell!

SUBMARINE CABLES LIMITED, of Greenwich, S.E.10, have again used I.C.I. polythene—in the insulation of the new telephone cable laid between Aberdeen and Bergen. This coaxial type cable with 7 submerged repeaters will enable 36 simultaneous two-way telephone circuits to be obtained over a distance of just over 300 nautical miles. This is, to date, the longest submarine telephone cable link in the world. Once again Polythene rings the bell.

Polythene — sold under the trade mark 'Alkathene' — is manufactured by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

ICI

We have extensive experience in the machining of our own electrical insulating materials. The group shows some of our work on

PAXOLIN LAMINATED, PANILAX LAMINATED & GREY VULCANISED FIBRE

m and i

THE MICANITE & INSULATORS CO. LTD

EMPIRE WORKS · BLACKHORSE LANE · WALTHAMSTOW · LONDON · E.17

BRANCH OFFICES at BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER and NEWCASTLE-UPON-TYNE and representatives in most countries throughout the world. In CANADA, MICANITE CANADA, LTD.

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS & TERMINALS. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit), Durajoint (Patented expansion jointing for concrete structures) and Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.)

Styrene Monomer

For the manufacture of POLYSTYRENE, SYNTHETIC RUBBER, POLYESTER RESINS, STYRENATED ALKYDS AND EMULSIONS BASED ON STYRENE and for use as a GENERAL CHEMICAL INTERMEDIATE

NOW MADE IN GREAT BRITAIN BY:

Forth Chemicals Limited

Grangemouth, Stirlingshire, Scotland.

SOLE SELLING AGENTS:

Monsanto Chemicals Limited

3 Victoria Station House,
Victoria Street, London, S.W.1.

In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Ltd., Montreal. Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India Ltd., Bombay. Representatives in the world's principal cities.

MONSANTO

Regd.

'LANCASTRIAN' MOULDING PRESS

The illustration shows one of our series of compression and transfer moulding presses which comprise 100, 150, 250, 400, 600 and 1,200 ton models. These presses can be fitted with core-pulling rams and other accessories and, together with the well-known 50-ton Fully Automatic Press, meet all normal requirements of the plastic moulder.

A standard range of presses is available for :—
CERAMICS, GRINDING WHEELS, FORGING AND DEEP DRAWING, METAL WORKING PLYWOOD AND SYNTHETIC BOARDS

Our Engineers are always pleased to discuss the design of special purpose presses to your requirements. Ancillary equipment can be supplied including our Rotocube mixers and Lancashire, Cornish and Economic boilers.

Please mention "Plastics" when requesting further information from

Foster Yates & Thom Ltd.

BLACKBURN, ENGLAND. Telephone: Blackburn 4224
London Office: Terminal House, Grosvenor Gardens, S.W.1 Telephone: Sloane 2255

FOUNDED 1826

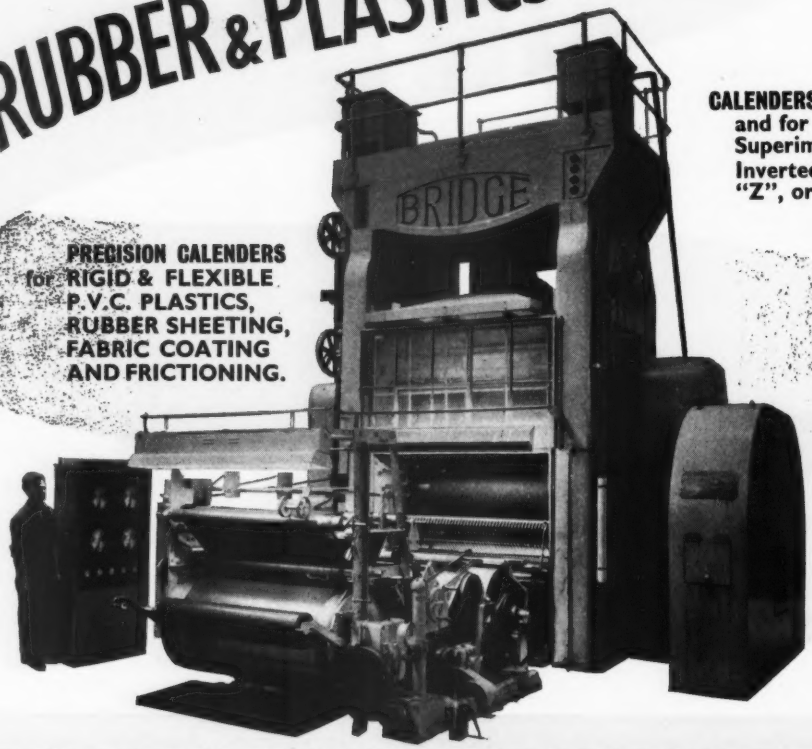
BRIDGE-BANBURY MIXING- INSTALLATIONS the acknowledged standard for high quality, high efficiency compounding.

BRIDGE

FOR RUBBER & PLASTICS MACHINERY

CALENDERS of all Types and for all purposes. Superimposed, Inverted "L", "Z", or Triangular.

PRECISION CALENDERS for RIGID & FLEXIBLE P.V.C. PLASTICS, RUBBER SHEETING, FABRIC COATING AND FRICTIONING.



DAVID BRIDGE & CO. LTD., CASTLETON, ROCHDALE, ENGLAND

Phone: CASTLETON/ROCHDALE 57216-7-8. *Cables:* "COUPLING" *Phone: Castleton, Lancs.*

LONDON OFFICE: BROUGHTON HOUSE, 6-7-8, SACKVILLE ST., PICCADILLY, W.1.

Phone: GROSVENOR 7480. *Cables:* "EDERACEO" *Piccy, London.*

ENGINEERS TO THE RUBBER & PLASTICS INDUSTRIES

PHENOL

A high-quality synthetic product meeting the most stringent requirements of the plastics industry.

XYLENOLS

A grade of refined cresylic acid of distillation range approximately 215-230°C. Total tar acid content 99.5 to 100%.

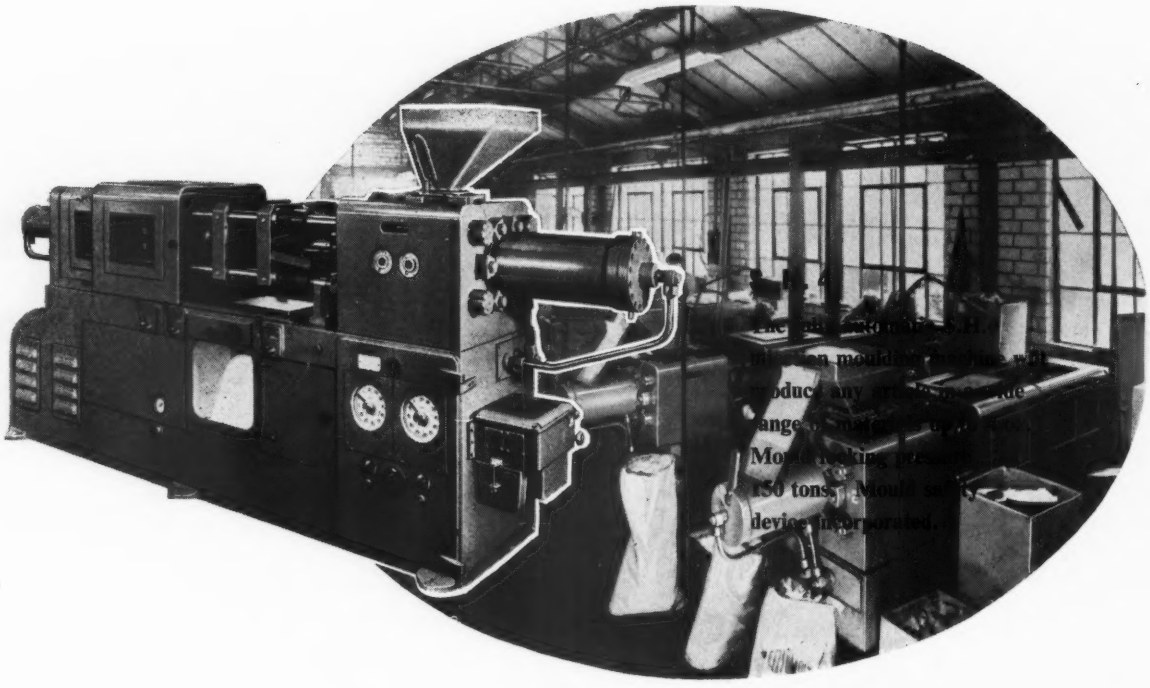
Availability:

Ample supplies for prompt delivery in road tank-wagons and in 40/45 gallon drums.

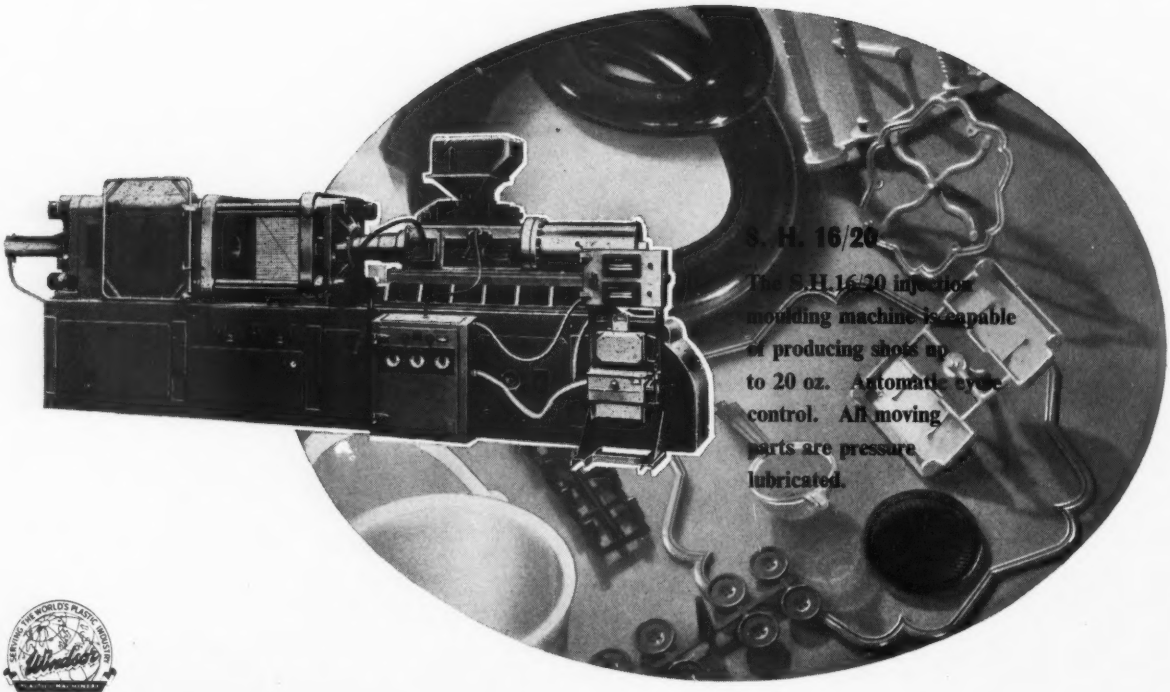
For further information, consult:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

B.244



INJECTION MOULDING

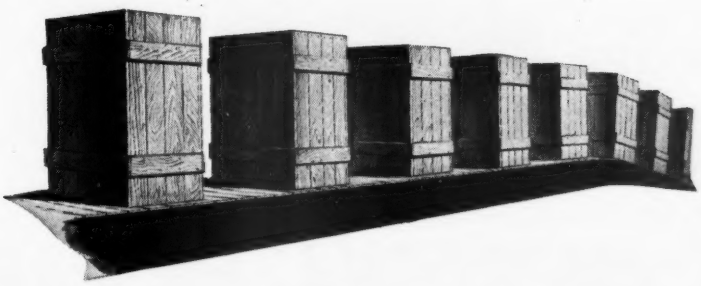


S. H. 16/20

The S.H.16/20 injection moulding machine is capable of producing shots up to 20 oz. Automatic cycle control. All moving parts are pressure lubricated.

Head Office and Works:
LEATHERHEAD ROAD · SOUTH CHESSINGTON · SURBITON · SURREY
Telephone: Epsom 5631 Telegrams: 'Winplas,' Surbiton, Surrey
London Office:
49 Upper Brook Street · London W.1 *Telephone: Mayfair 9020 (12 lines)*

we were all over the place



until we called in KING *(and got things moving)*

Inefficient, outdated handling methods can play havoc with production figures. They eat up the minutes, the man-hours and the money. More and more production men are becoming aware of the need for modern mechanical handling methods. If you're not happy with your present handling methods, **call in KING and get things moving.** *Our representative will call on you—anywhere in the world.*

***STREAMLINE* YOUR PRODUCTION WITH**

KING REGISTERED TRADE MARK **CONVEYORS • CRANES • PULLEY BLOCKS**

Covered by British and Foreign Patents

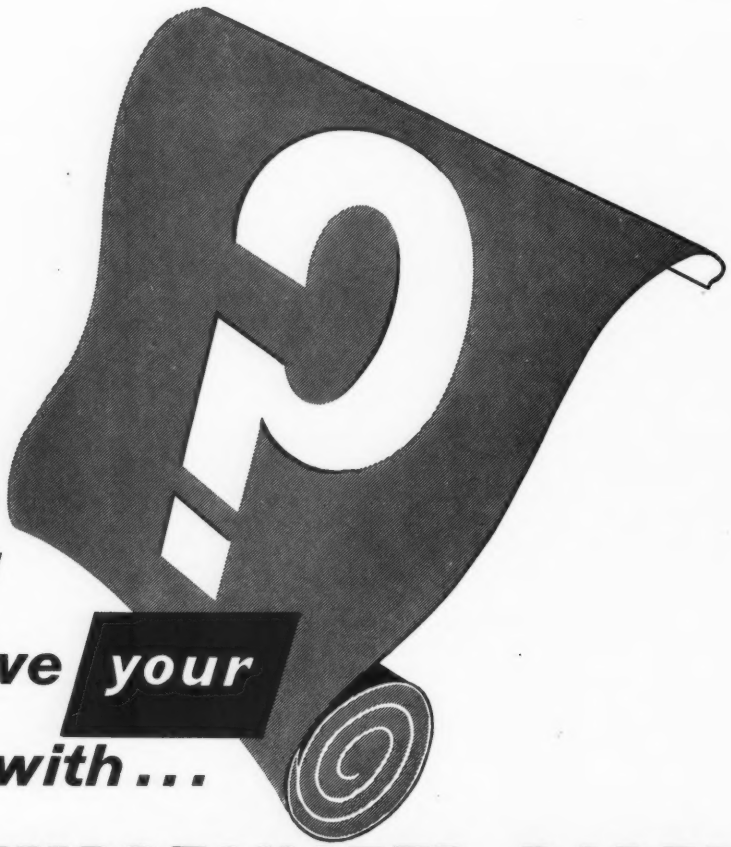
A KING P.C.P. LIGHT-TYPE CONVEYOR *carrying heater bodies at Valor Company's Works. For loads up to 200 lbs.*

A KING OVERHEAD TRAVELLING CRANE—*cab controlled—working with precision in a foundry.*

A KING POWER-PULLED HEAVY DUTY CONVEYOR *shown working at the Robbialac factory. For loads up to 1 ton.*

WRITE FOR ILLUSTRATED LEAFLETS TO GEO. W. KING LTD., 67 Argyle Works, Stevenage, Herts. Telephone: Stevenage 440

D



Can you improve your products with...

RESIN IMPREGNATED PAPER?

Now widely developed by Catalin Products Ltd . . .
Resin Impregnated Paper is finding its way into many new and unusual applications for improving product performance.

FILTRATION

Take MICRO-POROUS FILTERS for the electrical and automotive industries. Here, as a result of research and experiment, Catalin Products have devised materials with ideal electrical and filtration properties, which have proved highly successful as SEPARATORS and for OIL FILTRATION. And, by a scientific combination of paper texture and resin formula, the properties and porosities of this type of filter are so determined that they exactly meet any specific requirement. This wide-range application opens up whole new fields of opportunity for the betterment of products.

INSULATION

Resin Impregnated Paper is also in growing demand for *other* important purposes in the electrical field and in the building industry. For instance, specialised papers for the electrical insulation of components can be supplied in varying forms, and in the development of light weight structural materials with good thermal insulation, impregnated papers can play a vital part.

DECORATION

The material provided for this application, e.g. as a furniture surface for industrial and domestic purposes, is based on amino and phenolic resins, and when processed at low pressures and temperatures, provides a hard, smooth finish, resistant to abrasion, weak acids, alkalis and heat and easily cleaned.

IF YOU THINK RESIN IMPREGNATED PAPER CAN HELP YOU....

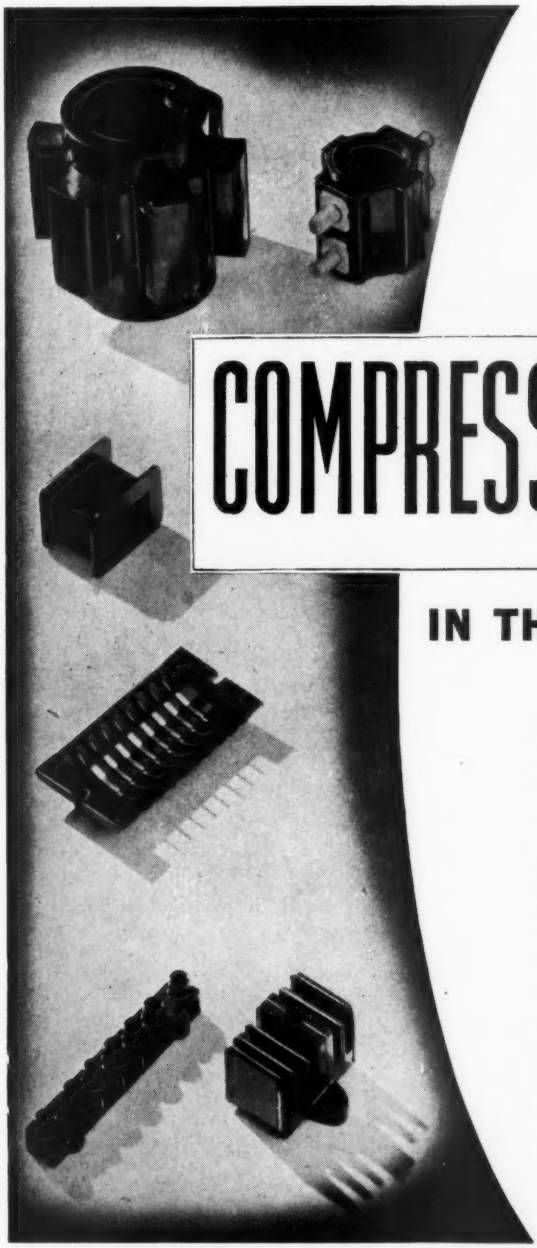
to solve a design or production problem, please get in touch with us. Our Technical Division is ready to 'get to grips' with any project and work with you in developing it. For this kind of co-operation please write or telephone and ask us to call.

CATALIN PRODUCTS also supply the specialised needs of Industry for: LAMINATED PLASTICS, CAST RESINS, REINFORCED PLASTICS.

Catalin Products

CATALIN PRODUCTS LIMITED, WALTHAM ABBEY, ESSEX. TEL: WALTHAM CROSS 3344

A MEMBER OF THE Catalin GROUP



TP DUNSTABLE

COMPRESSION and TRANSFER MOULDINGS

IN THERMO SETTING MATERIALS

Many famous firms have discovered that by approaching THERMO-PLASTICS LTD. their moulding problems are simplified. They know that complex shapes and intricate designs will be faultlessly moulded in any quantities with precision and complete fidelity to the original pattern.

You, too, can entrust your work to Thermo-Plastics Ltd. where production is planned to keep abreast of customers' requirements.

A highly qualified technical staff is at your service.

Thermo-Plastics Ltd.

Moulders and fabricators of all plastic materials, including glass and asbestos reinforced laminates, Perspex, P.V.C., Polystyrene, Cellulose Acetate, Polyethylene, Nylon, Phenol - Formaldehyde, Urea - Formaldehyde, etc.

THERMO-PLASTICS LTD. · DUNSTABLE · BEDS

Telephone: DUNSTABLE 1444 (6 lines) *Telegrams:* THERMOPLASTICS, DUNSTABLE

Finishing in grand style

We would not dream of trying to finish the mile in under four minutes, but we are confident that the finishes achieved through the use of our various materials and compounds will break all records for speed and brilliance.

Readers are invited to send to Lacrinoid Products Ltd., samples of the "work" with which they are concerned. Lacrinoid will investigate the problem by practical tests and will submit a report (without charge) including estimates of the process costs involved.

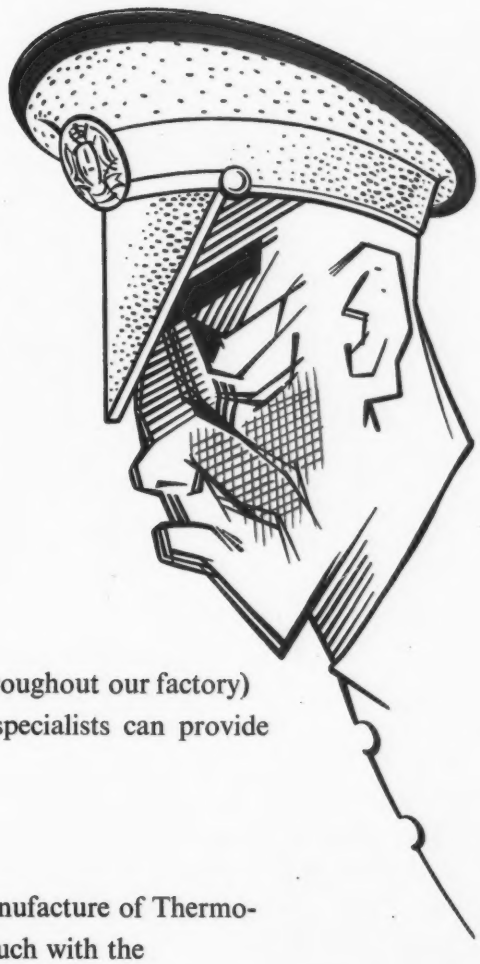
LACRINOID BARREL POLISHING **MATERIALS**

"Finer Finishing Faster"

LACRINOID PRODUCTS LTD · GIDEA PARK WORKS · STAFFORD AVENUE · GIDEA PARK · ESSEX · *Tel:* Hornchurch 2981

MCN 804

M.P.



stands for . . .

many things besides **M**ilitary **P**oliceman
or **M**ember of **P**arliament!

There's **M**ODERN **P**LANT, of course (found throughout our factory)
. . . and **M**ORE **P**RECISION which our skilled specialists can provide
. . . and **M**AXIMUM **P**RODUCTION
at a **M**INIMUM **P**RICE.

In any difficulty concerning the design or manufacture of Thermo-setting Plastic components, make sure you get in touch with the Specialists—and lose no valuable production time!

CERTIFIED ZINC ALLOY ZAMCA DIE CASTERS

Write or ring

METROPOLITAN PLASTICS LTD

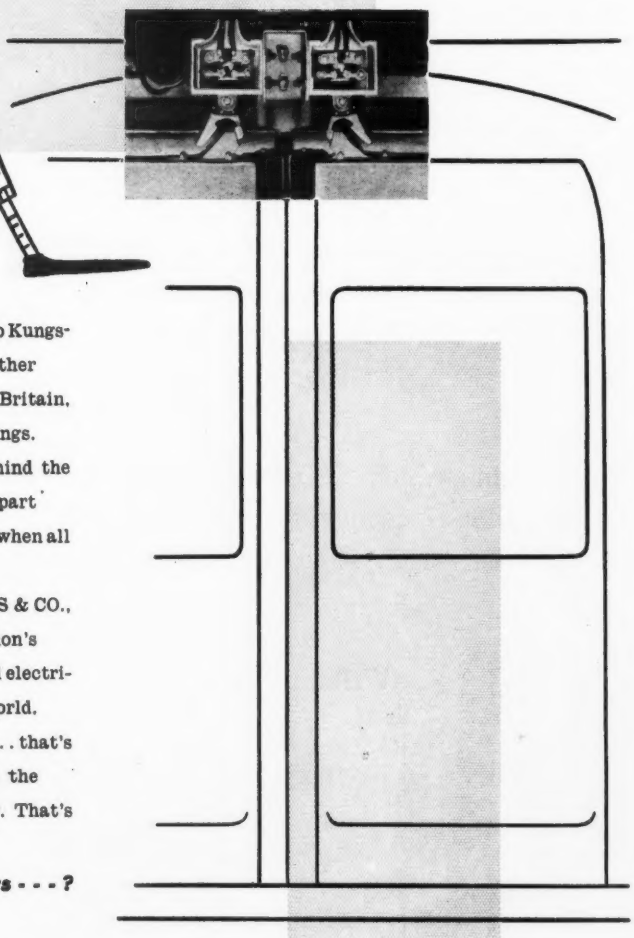
'Phone: TIDEWAY 1172-3

GLENVILLE GROVE · DEPTFORD · LONDON · S.E.8

A.I.D. Approved Factory

B

where are you going - - - ?



From Hammersmith to Piccadilly—Vallingby to Kungsgaten? Or, maybe, Rio de Janeiro to Sao Paulo? Whether it's by tube, subway or many surface lines in Britain, Sweden or Brazil, you travel with ROOTES mouldings.

They're silent passengers, though. Hidden behind the automatic sliding doors of each coach, they form part of a safety mechanism which signals the guard when all doors are closed and the train may move.

We produce these mouldings for G. D. PETERS & CO., who manufacture rolling stock equipment for London's Underground, the new Stockholm Subway, and electrified lines in Britain and Brazil, in fact all over the world.

From design to production through *all* stages . . . that's the practical way in which ROOTES deal with the scores of plastics problems that come along. That's why so many people bring theirs to us.

Now, where are you going with yours - - - ?

ROOTES
MOULDINGS LTD

CONTRACTORS TO
M.O.S., ADMIRALTY, ETC. A.I.D. APPROVED

SLOUGH · BUCKS · TELEPHONE: SLOUGH 22349

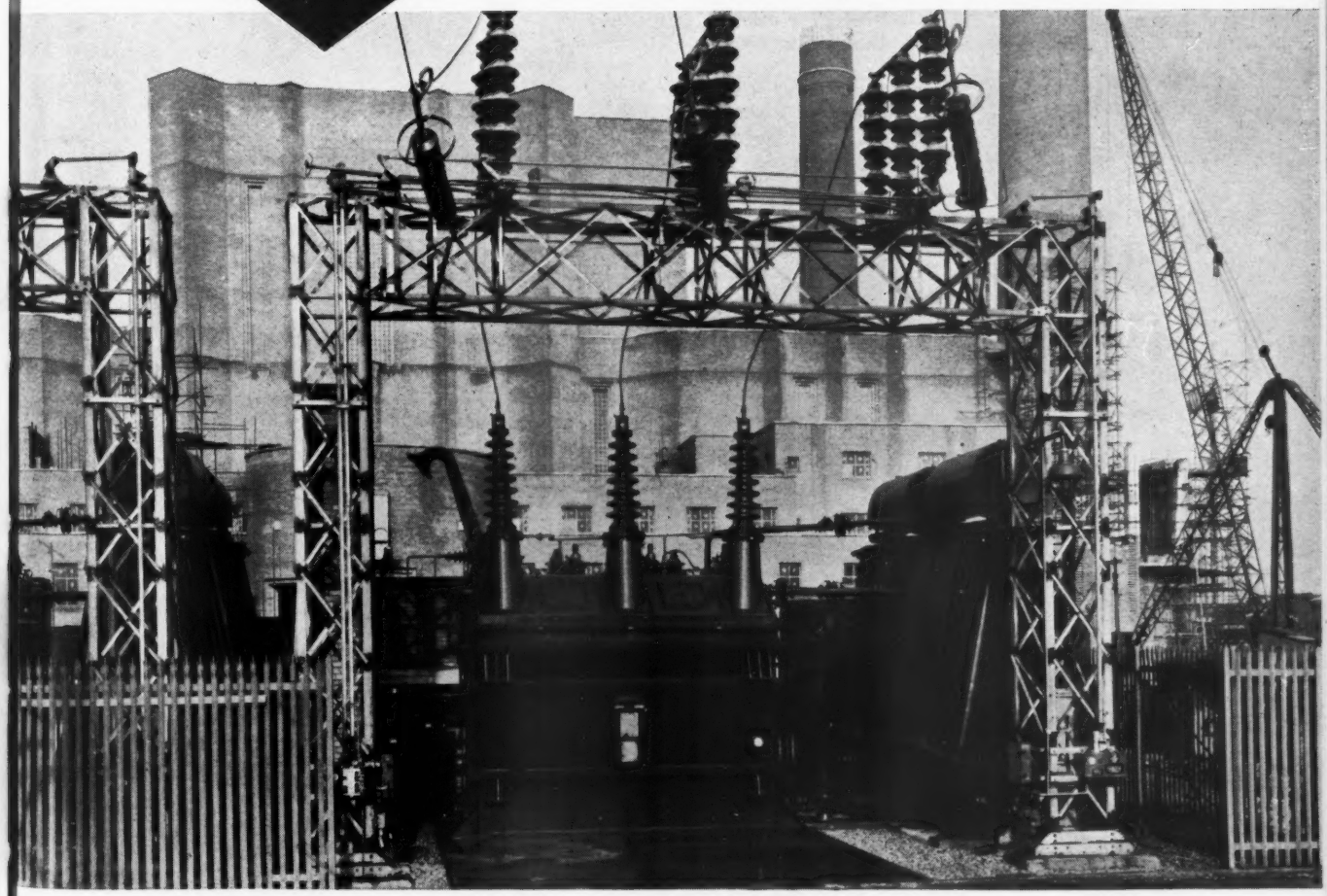
The Power of Paper...

45 MILLION

VOLT-AMPS KEPT AT

BAY BY PAPER!

This is a 45 M.V.A. power transformer which feeds the grid at a large power station in Croydon. The vital insulators for the tremendous voltages involved are made entirely from *paper!* Paper—treated in a highly specialized way, turning it into a most necessary component of all power equipment. This is merely one of many instances where the latent strength and power of paper is harnessed to the needs of industry. For all such specialized uses, Tullis Russell, with nearly 150 years experience, are the people to know. They are at your service!

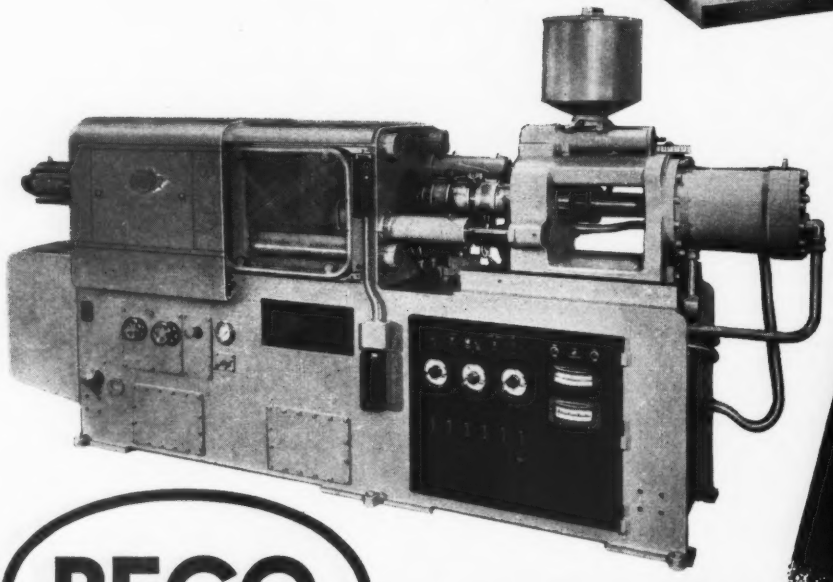


Tullis Russell & Co. Ltd.

ESTD. 1809 • SPECIALISTS IN THE MANUFACTURE OF TECHNICAL PAPERS FOR INDUSTRY

SCOTLAND AUCHMUTY & ROTHES PAPER MILLS, MARKINCH, FIFE
BIRMINGHAM 177 CORPORATION STREET
LONDON 'IVOREX HOUSE', UPPER THAMES STREET, E.C.4
MANCHESTER 372 CORN EXCHANGE BUILDINGS, CORPORATION STREET

INJECTED or EXTRUDED



PECO

MAKE THE MACHINES -THAT DO THE JOB

Illustrated literature is available on all PECO machines and will be gladly sent on request.

Peco Injection Moulding Machinery is now well established throughout the world as equipment in which the best engineering skill and experience are combined with the latest developments in Plastic technology.
A recent addition to the PECO range of machines for the Plastics Industry is the 2½" Universal Extrusion Machine which is illustrated above. This machine aroused much interest at the 1953 Plastics Exhibition in London.

PECO PRODUCTS

Enquiries to :

PECO MACHINERY SALES (Westminster) LTD.

28, VICTORIA STREET :: LONDON, S.W.1. :: ENGLAND
Telephone : ABBey 1793/4/5 Telegrams : PROFECTUS, SOWEST LONDON Cables : PROFECTUS LONDON
Reg. Office and Works:
THE PROJECTILE & ENGINEERING COMPANY LTD., ACRE STREET, LONDON S.W.8

The distinctive merits of STERNITE

STERNITE moulding materials and synthetic resins have become established as of outstanding quality: they are available in a wide range of grades and types, many specially evolved to meet customers' requirements.

★ Excellent quality

★ Immediate delivery by our transport

★ Considerable price advantages

★ Personal attention

★ Expert Technical Service

STERNITE **Phenolic Moulding Powder**

FOR COMPRESSION AND TRANSFER MOULDING

General Purpose Grades: (Types G and GX) conforming to B.S.S. 771	All of exceptional quality for their particular applications and in a range from which it is possible to meet any specification with absolute confidence.
Other Grades available include:	Shock resisting, Water resisting, High dielectric, Telephone Grade 1, Heat resisting, Acid resisting, Cabinet, Odourless, etc., etc.

STERNITE **Synthetic Resins**

for wood, paper and fabric base laminates suitable for decorative, electrical and mechanical purposes.

also available:	Novolak Resins for Moulding Powders, Liquid Resins for Grinding Wheels, etc.

Sterling

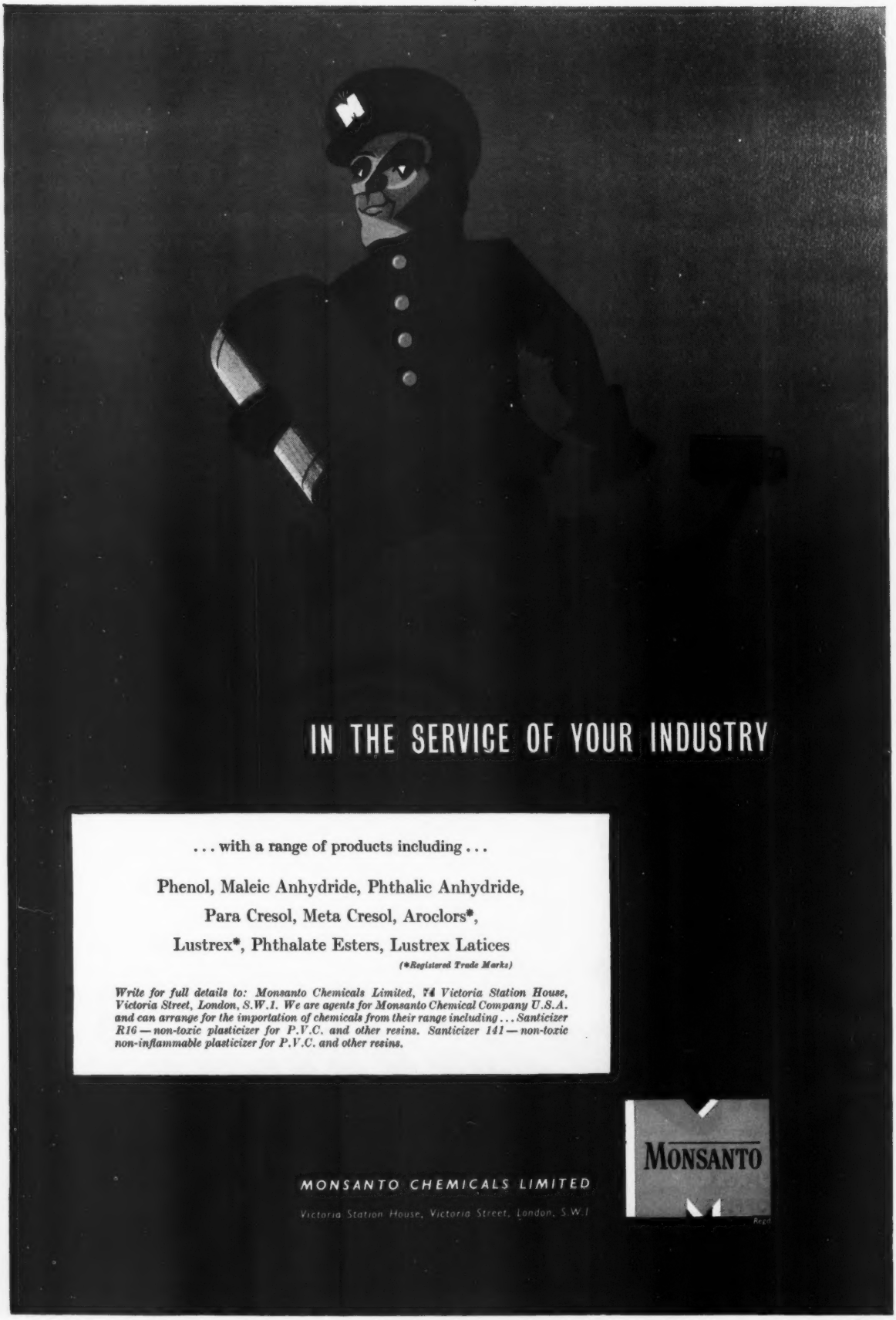
MOULDING MATERIALS LTD.

A.I.D., M.O.S., POST OFFICE, ADMIRALTY APPROVED
B.S.I. HALL-MARK CERTIFIED

S.7

STERLING MOULDING MATERIALS LTD., STERLING HOUSE, HEDDON STREET, LONDON, W.1. *Works: STALYBRIDGE, CHESHIRE*
Phone: Grosvenor 5301/10 Grams: Stermold, Piccy, London Cables: Stermold, London

Members



IN THE SERVICE OF YOUR INDUSTRY

... with a range of products including ...

Phenol, Maleic Anhydride, Phthalic Anhydride,
Para Cresol, Meta Cresol, Aroclors*,
Lustrex*, Phthalate Esters, Lustrex Latices

(*Registered Trade Marks)

Write for full details to: Monsanto Chemicals Limited, 74 Victoria Station House, Victoria Street, London, S.W.1. We are agents for Monsanto Chemical Company U.S.A. and can arrange for the importation of chemicals from their range including ... Santicizer R16 — non-toxic plasticizer for P.V.C. and other resins. Santicizer 141 — non-toxic non-inflammable plasticizer for P.V.C. and other resins.

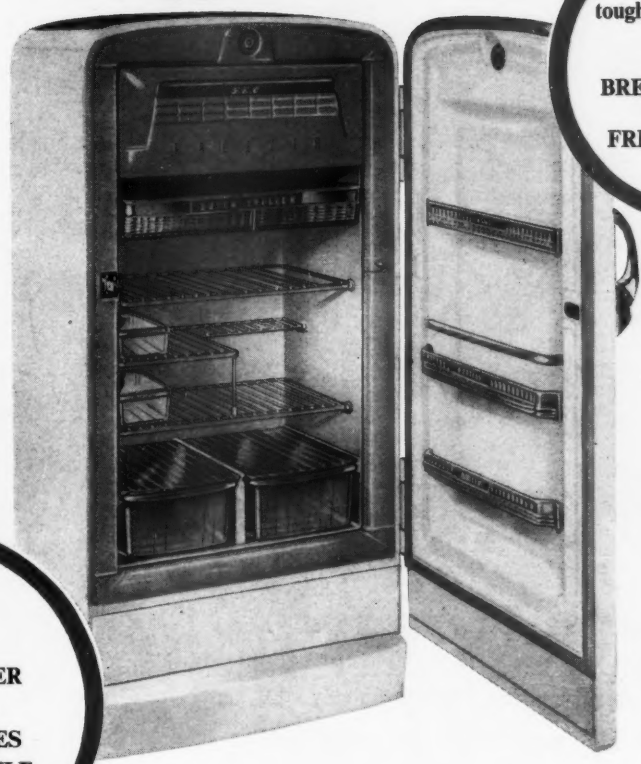
MONSANTO CHEMICALS LIMITED

Victoria Station House, Victoria Street, London, S.W.1

MONSANTO

Regd

Erinoid polystyrene for G.E.C.



CP.20 grade toughened polystyrene copolymer for the BREAKER FRAME and FREEZER DOOR

KLP grade polystyrene for the QUICK CHILLER SALADORS BUTTER DISHES EGG AND BOTTLE SHELVES

In their new eight cubic feet and five cubic feet domestic refrigerators G.E.C. are using Erinoid polystyrene for all the moulded fittings.

High impact CP.20 grade is tough and strong to withstand the rigours of assembly and daily use. KLP grade is ideal for the transparent mouldings. Both materials flow easily during moulding and give a fine lustrous finish. For this application the two-tone green colour matches were specially produced. Erinoid polystyrene is ideally suited for low temperature applications. It is available as moulding powder, sheet and extruded sections.

Erinoid polystyrene is manufactured by

STYRENE PRODUCTS LIMITED

Full information, samples, prices etc., on application to

ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

Telephone: Stroud 810

London Offices: 96 PICCADILLY · LONDON · W.1 · Phone: GROsvenor 7111

it's tough enough!

They moulded it in

Kleestron H

THE NEW HIGH IMPACT POLYSTYRENE

Like the coat hanger here, some plastic products really have a rough time—but moulded in new Kleestron H they'll bear up under treatment that would soon put paid to articles made of normal polystyrene. It's the high impact strength of Kleestron H (three times greater than standard) that makes it so extra-tough. Only after intensive research followed by stiff tests under actual moulding conditions has this hardy plastic been introduced into Kleestron's famous range. Manufacturers will find Kleestron H the perfect polystyrene for products destined to lead a knockabout life.

IMPACT STRENGTH 3 times standard

MOULDABILITY better than ever

PROPERTIES similar to standard

COLOURS available in a range of opaques

Kleestron LTD

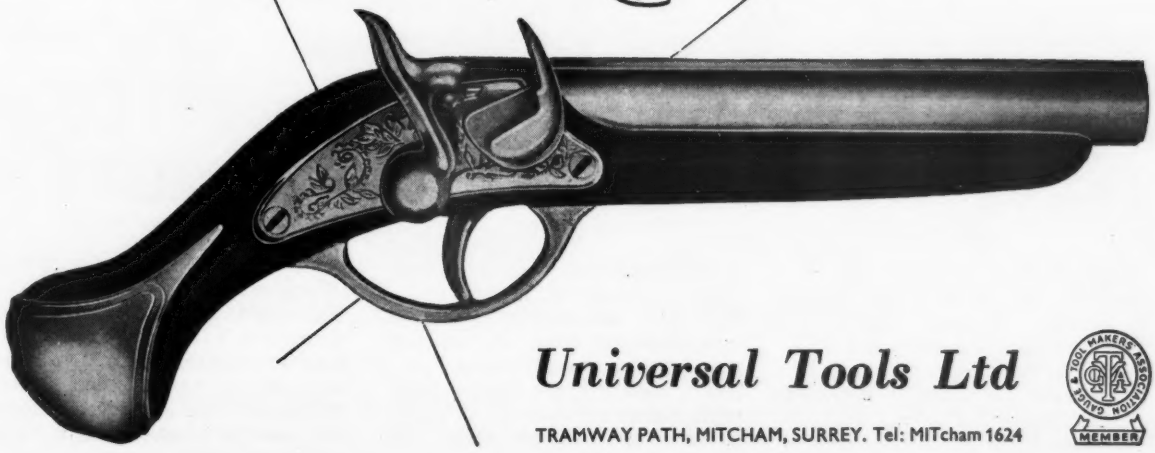
WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON S.W.1

'Phone: SLOane 0866

Britain arms young America...

Selling in large numbers in America, this toy pistol is externally an authentic copy of a period weapon. A combination of plastic and die-cast parts, it fires either a plastic ball or dart, making a very satisfactory noise in the process.

Beautifully finished and well designed for economic production, it has scored a direct hit for The British Mouldmaker—Universal Tools, of course.

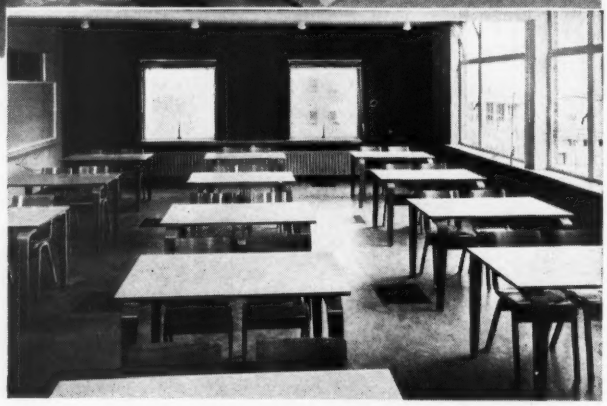


Universal Tools Ltd

TRAMWAY PATH, MITCHAM, SURREY. Tel: MITcham 1624

TOOL MAKERS ASSOCIATION GAUGE MEMBER

This little girl can draw, write and spill paint on this new table-top. A quick wipe will make it clean—and it will then be used for dining.



Photographs by courtesy of Thomas De La Rue Ltd.

Double role for table-tops at NEW SCHOOL

At the new Kidbrooke School in Greenwich—the L.C.C.'s first Comprehensive School—new table-tops perform a double function. They are used not only for lessons but for dining too.

This double role is possible because a famous laminate that is based on Melamine resins was chosen. Easy to clean and hygienic, the surface has a glossy, scratch-resistant finish that is far superior to any previously used.

Not only in schools—*wherever* they are used, laminates based on Melamine resins are the best available today.

B.O.C. make only the *chemical* Melamine. Names and addresses of manufacturers of Melamine resins and moulding powders will be supplied with pleasure. Please write for further information to:

Chemicals Division, British Oxygen Company Limited, Vigo Lane, Chester-le-Street, Co. Durham. *Tel: Birtley 145.* London Office: Bridgewater House, Cleveland Row, St. James's, London, S.W.1. *Tel: Whitehall 9777.*

PIGMENTING TYPES

BASIC LEAD CARBONATE

—specially prepared for P.V.C. Supplied only as dispersed paste with Plasticisers to choice.

DIBASIC LEAD PHOSPHITE

TRIBASIC LEAD SULPHATE

Stabilisers for P.V.C.

A complete system available for heat, light and dielectric requirements.

TRANSLUCENT TYPES

LEAD SILICATE

DIBASIC LEAD STEARATE

LEAD STEARATE

CADMIUM STEARATE

CALCIUM STEARATE

BARIUM STEARATE

LITHIUM STEARATE

With the exception of White Lead (Basic Lead Carbonate), these Stabiliser/Lubricants are supplied dry, or as non-settling dispersions which facilitate easy mixing and efficient intimate contact with P.V.C.

ASSOCIATED LEAD MANUFACTURERS LIMITED

SPECIAL CHEMICALS DIVISION, CRESCENT HOUSE, NEWCASTLE UPON TYNE 1, ENGLAND

ASSOCIATED LEAD PRODUCTS

F*

Concerning

VINATEX
P.V.C. COMPOUNDS

In general

Vinatex Limited manufacture a complete range of Polyvinyl chloride compounds which can be supplied in the form of chips, slabs or uniform pellets.

In particular

We make compounds for... Petrol resistant extrusions. Non-toxic extrusions. Rigid anti-shatter extrusions. Dielectric, direct insulation and sheathing purposes. High clarity extrusions. General purpose extrusions. Gramophone records.

In addition

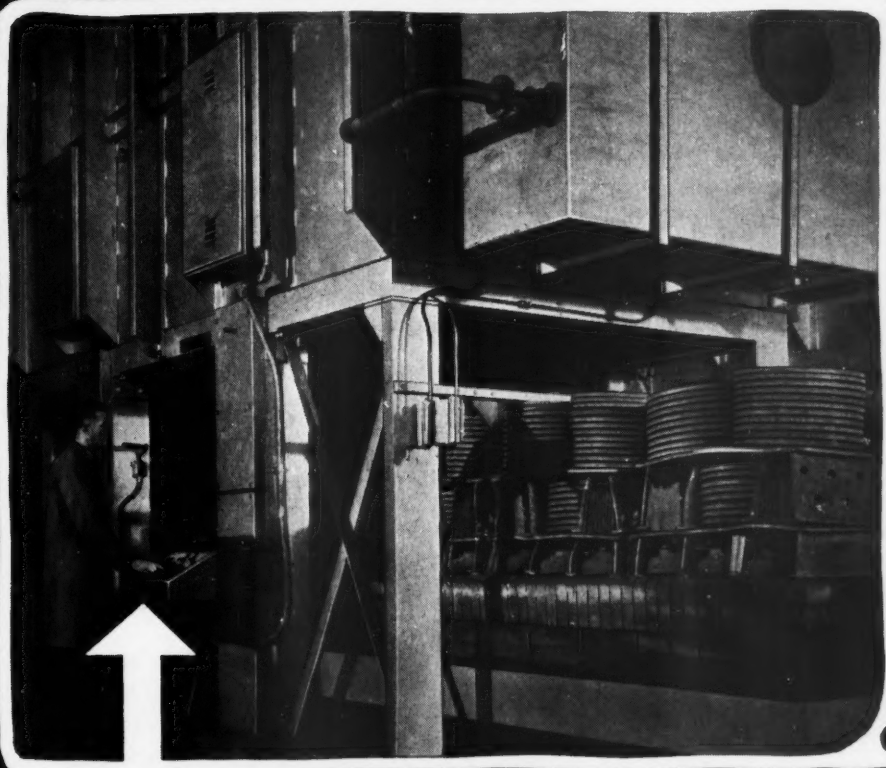
We make polyvinyl chloride pastes, "Vinamold" hot melt compounds, "Vinagel" modelling and moulding materials and "Vinatex" Coated paper and cloth.

WE INVITE YOUR ENQUIRIES.

VINATEX LIMITED, Devonshire Rd., CARSHALTON, Surrey
Wallington 9282

VINATEX LIMITED IS A UNIT OF VINYL PRODUCTS LIMITED

V36



Load charge!

The finger on the button, a slight movement — and into the furnace go five or more tons of castings. Like all iron castings they go in brittle, but after a cycle of heat, soak and slow cool in the controlled atmosphere, they come out malleable. Gaseous annealing in an electric furnace is quick and efficient — whereas conventional methods, involving packing in boxes, require much fuel, labour and materials. For consistent high quality in the product, for cleanliness in the works, and for low costs in the process, there is nothing like an electric annealing furnace — but it is

only one of the many aids to higher productivity that Electricity can bring you.

Having a hand in Productivity

In every industry or trade, electrical equipment is the key to modern production methods. There are probably more production-boosting and money-saving devices than you know of. Your Electricity Board can help you and give you sound advice.

They can also make available to you, on free loan, several films on the uses of electricity in Industry — produced by the Electrical Development Association.

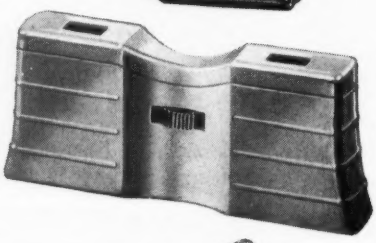
E.D.A. are publishing a series of books on " Electricity and Productivity ". Four titles are available at the moment; they deal with Higher Production, Lighting, Materials Handling, and Resistance Heating. The books are 8/6 each (9/- post free) and the Electricity Boards (or E.D.A. themselves) can supply you.

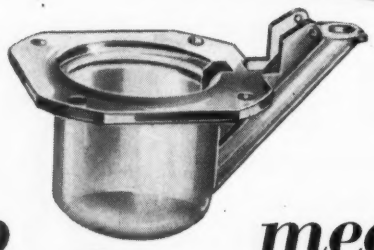
The British Electrical Development Association
2 Savoy Hill, London, W.C.2.

Electricity a Power of Good for PRODUCTIVITY

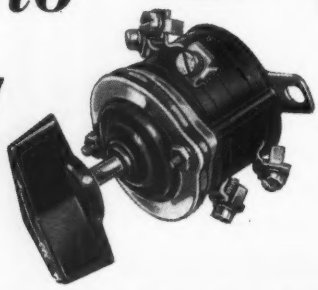
if you want precision

Our knowledge of moulding technique, developed during thirty years specialised experience as compression and injection moulders, allied with our acknowledged ability to meet the close limit accuracy demanded by industry, combine to make us the obvious source of supply for plastic mouldings where precision and high quality finish are essential attributes. Four factories with large modern plants can be placed at your disposal, and are well equipped to meet all your requirements.



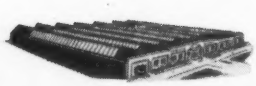


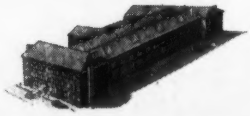
we want to meet you



E. Elliott LIMITED

315 SUMMER LANE, BIRMINGHAM, 19 *Tel.: Aston Cross 1156-7-8-9*

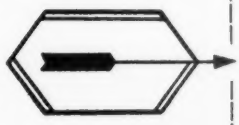




THE PLASTIC MOULDERS WITH THE ENGINEERING BACKGROUND

PCL

PURE CHEMICALS LIMITED



IMPORTANT ANNOUNCEMENTS

Pure Chemicals Ltd. have pleasure in announcing:

1 *That by arrangement with*
THE FERRO CHEMICAL CORPORATION of U.S.A.
they will act exclusively as the Corporation's manufacturing and distributing agents in Europe

2 *That by agreement with*
SHELL CHEMICALS LIMITED
they are now able to offer
'EPIKOTE' RESINS
in the P.V.C. *Stabiliser field under their* "STANCLERE" *trade name*

The combination of these resources with the existing "Stanclere" series will enable Pure Chemicals Ltd. to offer a complete range of P.V.C. stabilisers of all types, both straight chemical and compounded.

The installation of a complete demonstration plant and customer service laboratory at Kirkby will facilitate satisfactory formulation for each user's needs.

There is a series of monographs on 'STANCLERE' STABILIZERS gratis for the asking.

PURE CHEMICALS LTD · PLASTICS DIVISION · KIRKBY INDUSTRIAL ESTATE
NEAR LIVERPOOL TELEPHONE: SIMONSWOOD 2241

G

BACKGROUND TO BETTER MOULDINGS

Fundamental research into the nature of plastics is an important part of a busy development programme at Bakelite Limited. This photograph shows a chemist conducting one of the many tests which help to maintain the high quality of BAKELITE *products*

In many industrial applications, components moulded from BAKELITE Products have proved to be more economical and more serviceable than those made from conventional materials. This viscose spinning box cover is just one example of the increasing use being made of BAKELITE materials in the textile industry. Moulded from BAKELITE rubber modified phenolic material, it has excellent resilience under shock, and will resist water and acids. This material is also being used for moulding various types of heavy duty electrical accessories, and is just one of the many BAKELITE Products helping in all branches of industry to cut costs and speed production.

Moulded by Ashdowns Ltd. from BAKELITE *rubber modified phenolic material X17181/1.*

First and still Foremost

Producers of ***Bakelite*** *Phenolic, Urea, Alkyd & Silicone Moulding Materials* ***Bakelite*** *Polyester Resins ·* ***Bakelite*** *Phenolic & Urea Resins, Cements & Adhesives ·* ***Bakelite*** *Laminated Sheet, Rod & Tube ·* ***Bakelite*** *Glass Fibre & Asbestos Laminates · Vybak PVC Moulding & Extrusion Compounds Vybak Rigid & Flexible PVC Sheet · Warerite Decorative Laminated Plastics*

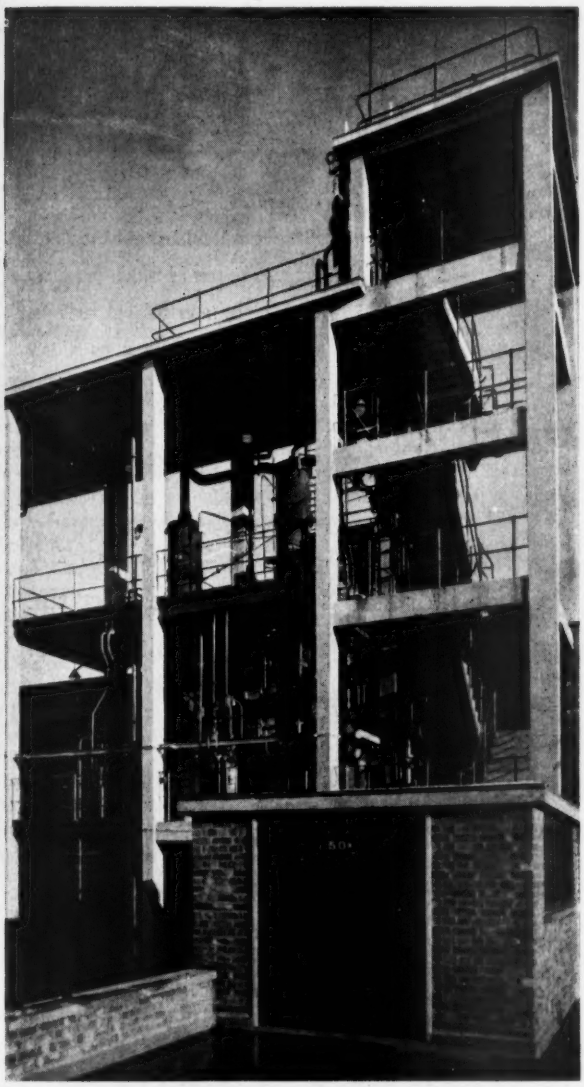
Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

EDITOR: M. D. CURWEN, B.Sc., A.R.I.C.
ASSISTANT EDITOR: C. W. WELCH



The new British Oxygen Company's plant for the production of polyvinyl acetate at Chester-le-Street.

CONTENTS

	Page
Editorials	67
Moulding Powder and Shot	68
Decoration on Moulded Ware	69
Pressure Bottles in Reinforced Plastics	70
New Plant for the Production of Vinyl Acetate	72
Plastics and the Comb	73
Plastics in the Service of Man	76
Letters to the Editor	78
Recent Developments in the Sheet Moulding of Perspex	79
Alkyd Moulding Compounds for Electrical Insulation by G. Bell and J. A. Willey, B.Sc., A.R.I.C.	82
World's Industry Employs Plastics	85
New Productions	86
Plastics News	87
Talking Shop	90
Properties and Testing of Plastics Materials by A. E. Lever, A.I.R.I. and J. Rhys, M.Sc.	91
Metal Soaps as Vinyl Stabilizers, by W. G. Vennells, A.M.C.T., A.I.R.I., A.P.I.	93
Patent Review	97

Printed in England and Published monthly by the Proprietors, Temple Press Limited.

Annual Subscription Rate 34/-. Shorter periods pro rata.

Advertisement and Publishing Offices:
Bowling Green Lane, London, E.C.1.
Telephone: TERminus 3636

Editorial Offices:
27 Shaftesbury Avenue, London, W.1
Telephone: GERrard 4406

NP 16

To the initiated this sectional view of the brush holder tells the whole story. The mould which produces it has eight interlocking parts yet we produce as many as thirty finished mouldings in an hour.

flexible plastics do a good job for HOOVER

Flexible, tough and pleasant to handle, this brush holder is a good example of the right way to use polyvinyl chloride plastics (P.V.C. for short). As one would expect the makers of the famous Hoover cleaning equipment have not been slow to exploit the real advantages of moulded plastics, their adaptability and speed of production.

National Plastics make very large quantities of moulded and extruded plastics components for big industrial organisations. A telephone call to Larkswood 2323 will bring you practical advice about what can be done to your advantage by these versatile materials.

SALES ORGANISATION FOR
BRITISH MOULDED PLASTICS LTD.
Avenue Works, Walthamstow Avenue, London, E.4
LARkswood 2323

NATIONAL PLASTICS (Sales) LTD

Plastics

VOL. XX. No. 212 MARCH, 1955

EDITORIALS

Next Industrial Revolution

NEARLY ten years ago, the first "atomic" bomb was dropped and the world became acutely aware of the power of nuclear energy. At that time we wrote of some of the obvious possibilities that lay ahead by applying this new form of power to peaceful industrial activities and of the hope that Gt. Britain, since she had done as much as any other country in the original physical research work on the subject, would be able to participate in the strange, glittering future that lay before us.

The story of the growth of the vast new industry has already been told. We now possess a powerful organization with its headquarters Production Division, at Risley, Lancashire, the research station at Harwell, the uranium Springfield works at Selwick, the production piles and the separation of plutonium from irradiated uranium at the Windscale works near Sellafield, in Cumberland, and the newer diffusion plant to concentrate fissile uranium 235 at the Capenhurst factory in Cheshire. Every factory came into operation within a month of the estimated date; the cost of every plant was within a small percentage of the estimated sum and the first bulk output of plutonium was produced on the date specified. All this has been created and built with our own endeavours in seven years from 1946, starting from scratch, since the British workers who had gone to the U.S.A. in 1943 were not given access to information regarding the design or performance of the existing piles. A generous and clear-minded American scientist recently told an American audience that ". . . the British returned home and built better and cheaper ones."

Now the Government announces a plan for the building of 12 nuclear power stations at a cost of £300 million to provide a total capacity of nearly two million kilowatts of electricity by 1965.

Of the magnificent work of our scientists in this we express our sincere admiration and we should offer our thanks also to the different Governments who since the war and seemingly with complete absence of party factions, have fostered a new industry of immeasurably great promise with a courage and vision that has never been surpassed in our history. The rest must be a story of maintaining research, of wise and unstinting expenditure with which every individual must concur and must welcome, and of a new surge in our educational and technical training systems.

The production of nuclear power heralds a new era for the world and perhaps to no country so much as this small, overpopulated, intensely industrialized island is its coming so immediately urgent, so that we may seize the opportunities it offers. The first industrial revolution began in this country when we developed our rich coal and iron fields, cotton and wool textiles and became the greatest exporting country in the world. Behind it all was the production of power from coal to drive the machines, and also from our coal by distillation we created new industries for the new civilization that was growing fast, fertilizers, dyestuffs, pharmaceutical compounds, plastics and a hundred other chemical products.

If the industrial revolution made us great, the rapidity of our growth in a small area and the waste of our assets has brought about inevitable set-backs, which have become so obvious. Our internal sources of power and the rate of production of coal are diminishing and demands by industry increase each year. It is, above all, for such reasons that atomic energy presents us with the opportunity of creating a second industrial revolution, compared with which the first will seem to future races but the crude groping of a one-eyed man in the country of the blind.

The 12 nuclear power stations, presuming that all goes smoothly, will be producing by 1965 little more than a quarter of the need for new generating capacity, so that this great and costly programme throws into clearer perspective the still vaster constructions that lie ahead towards the end of the 20th century. But the prize is worth fighting for, and as the White Paper just published states, "The stakes are high, but the final reward will be immeasurable. We must keep ourselves in the forefront of development of nuclear power so that we can play our proper part in harnessing this new form of energy for the benefit of mankind."

Gibbon has said that history is generally only the register of the follies and mistakes of mankind. No doubt we shall always make mistakes but at least we can be tolerably certain that the path we now follow is not folly. In any event the three sources of energy, coal, oil and fissile material will all prove complementary for very many years. Coal we shall always need for our ever growing chemical industry.

Reinforced Plastics

YET another stage in the development of reinforced structures for use in high speed aircraft has been reached with the announcement that large orders for the production of plastic drop tanks have been placed with the Bristol Aeroplane Co., Ltd. It seems clear that these are glass-fibre/resin structures since this famous company has done so much excellent work in the field for a number of years.

That the Ministry of Supply and the Royal Aircraft Establishment are satisfied with the performance of these tanks is further exemplified by the fact that the Ministry has decided to attempt standardization of the size and shape of aircraft drop tanks on all future British military aircraft. The basic aerodynamic design was worked out by the R.A.E. but the Bristol Aeroplane Company has been entirely responsible for the structural design, manufacturing methods and tooling processes.

To date the company has produced a series since 1952 ranging in capacity from 50 to 500 gallons. One of the most successful tests at speeds greater than that of sound has been made on 100-gallon underwing tanks fitted to the Hunter. The tanks replace the usual aluminium tank and are stated to be considerably less in cost. An interesting point is the provision of a metal nose cap moulded integrally with the front section to increase erosion resistance in flight. Obviously this protection is at the most vulnerable point in the tank, where radius of curvature is smallest.

MOULDING POWDER AND SHOT

Coal Hod in Laminate

While rubbing my nose against the window of a famous store in Victoria Street I came across what must be a rare if not the only example of the use of laminated "phenolic" sheet in the production of a public utility job—a coal bucket, or rather a coal hod (see left photograph). Inside the store I examined it closely and found it a most commendable job; it had been designed with care with a clear eye as to function and bears no resemblance to the inverted fireman's helmet of the 1890s. It is fabricated from the best African hardwood using five plies, each adequately resin-bonded so that it is immensely strong and waterproof. The base is especially so, being ½ in. thick. The whole structure is capacious yet light, can stand as shown in the photograph or be laid on its longest side. The makers, William Mallinson and Sons (Mfg.), Ltd., of Crayford, Kent, have also sent us a photograph of a prototype kitchen hod (see right) which will also be on the market soon. It is also of laminated plywood, but the "leading edge" has been strengthened so that it may be used for scooping fuel. It is clear that the base cannot drop out as so often does the metal type following rusting of the rim.

◆ ◆ ◆

Hope for Gardeners

The foregoing productions make me hope that the manufacturers will go in for shaped laminates for the public in a big way, and especially in a field I mentioned last year. I am convinced, since we are a nation of gardeners and spend enormous sums on our hobby, that there is a big market awaiting the adventurous company that produces a garden wheelbarrow with its body of post-formed well-impregnated laminate and shaped as deeply as possible. If handles and legs also of the same material can be added and fitted with p.v.c. shoes, so much the better. This market can afford to pay a premium for non-rusting properties on the one hand and resistance to moisture and therefore fungus on the other—the fight will be against both the sheet-metal barrow and the wooden barrow. Clearly the makers of some of the cheap galvanized iron-sheet barrows (costing 45s.) are behaving stupidly. The body is produced from five flat sheets bolted together with ungalvanized bolts which are in process of rusting in the distributors' yards, while legs and handles are crudely made from 1½-in. by ⅜-in. iron sheet. I hope I was the only buyer.

All-Plastic Town

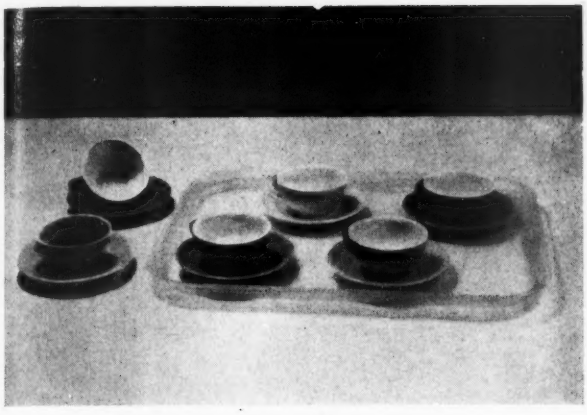
The notes regarding the recent Paris plastics exhibition in both the January and February issues, point out one great difference between the make-up of the French and British Plastics industries, namely the great and perhaps disproportionate number of small working units in France. We have a good number of small units in this country but we have nothing that resembles even remotely the little town of Oyonnax nestling at the foot of the Jura mountains. With a population of only 9,000, it may be considered a "plastic town" (it was born out of horn, celluloid and casein) for the number of moulders and fabricators listed in the French official index is about 400! It is indeed a town of artisans, working often with the beauty and ingenuity only good artisans can instil. The same list contains 1,000 plastic moulding units in Paris, but many of them are of considerable size and bear little relationship to the Oyonnax industry which obviously began many years ago as a village industry. Readers will be interested to know that an exhibition under the title of Salon des Plastiques will be held at Oyonnax on April 28 to May 3. I am certain that a good time will be had by one and all.

◆ ◆ ◆

Foggy Atmosphere

In my previous remarks in our February issue on the suggested use of the word "plastics" as an adjective, I wrote that no official English dictionary contains the word either as noun or adjective. This is not completely true since the Concise Oxford English Dictionary does contain both the singular noun "plastic" and the plural noun "plastics." On the other hand it is confusing to find that the Shorter Oxford English Dictionary, which is much larger than the "Concise," does contain the singular noun but not the plural. However, neither contains the adjective "plastics," which is so much more to the point. Nobody can object to bodies such as the British Standards Institute or the British Plastics Federation initiating a movement to clarify a very foggy nomenclature. Indeed initiative in this field is as welcome as it is important. But so far as my sparse knowledge of the history of the matter goes the discussions appear to have taken place in very narrow circles—at least I don't remember any of the meetings having been thrown open to general discussion by all branches of the industry. Nor is the action of the Plastics Institute clear (it does not appear as an entity to have joined the Federation in its latest recommendation); yet it acts as the educative body to the industry and should be well in the picture. Indeed, since the Institute flings its cloak widely, over scientists, technologists and designers, it seems the completely logical body to examine the whole problem. Since the history of this subject is little known to so many and, I believe, even to some who made the decisions in the first instance, a recapitulation by one of the authoritative bodies might serve a useful purpose. It would be interesting to know, for example, whether or not anybody proposed an entirely new word as a way out of the impasse—I mean a new fabricated word without any adhesions to existing words or to their technical meanings. It would have been relatively simple in earlier days and would have saved a lot of bickering. I suppose it's too late now, but I well remember one Fleet Street journalist coming to our office grumbling over the "plastics" horror and suggesting "polydon," which although a bit of a Græco-Roman hotchpotch, meaning, I suppose, "many gifts," is a pleasant effort indeed. However, any euphonious word even without a meaning would be acceptable.

DOGSBODDY.



Decoration on Moulded Ware

Fig. 1. Two-colour effect in cups made in Italy from laminated Perspex (*Polyplasti*).

WE make no apology for bringing up so frequently the question of decoration, applied design or multicolours on moulded ware, for the need—the public demand, we are sure, is there; at least the interest in our photographic displays in recent issues of this journal of decorated "melamine" tableware has aroused wide interest. These examples we may point out must be described as being still in the experimental stage and in this field especially applied art is conspicuously absent.

Nor is the attempt to introduce simple variegated colour new. As long ago as 1934, the well-known German plastics technologist Kurt Brandenburger who now publishes a monthly journal entitled *Der Plastverarbeiter*, described a method of producing two-colour mouldings in his book "Processes and Machinery in the Plastics Industry." Technically, a roughly analogous method is used today in making two-coloured injection moulded typewriter keys. The process described by Brandenburger never reached production level for no doubt it was limited in scope, results were not always satisfactory and the moulding of "phenolic" units was carried out in an atmosphere of fierce price competition. The author makes no mention of two-colour "urea" mouldings.

Today the bulk of successful application of art appears in decorated laminates, in the occasional "reverse engraving" found in small transparent acrylic brooches and the like, and the analogous "three-dimensional" work carried out on motor-car insignias and refrigerator name plates.

The production of variegated colour in tableware has now spread to the thermoplastic materials in a novel manner for we note in a new Italian journal *Polyplasti* a quite delightful result obtained by fabrication from two laminated sheets of differently coloured (opaque) Perspex. The photograph (Fig. 1) which we reproduce here shows a "Harlequin" set of cups and saucers—the inside and outside of each cup and saucer are in different colours and presumably no two cups and saucers are of the same colours. Obviously the use of such laminates could be expanded and it should be possible to interleave two transparent sheets prior to lamination with an appropriate design which would be visible. Such an application would appear possible not only with cups and saucers and plates but also with trays, food covers and other productions.

In passing there would appear to be plenty of scope for the adventurous by other ways of brightening similar ware and for what it is worth we should like to see moulded cocktail or champagne "glasses" of Diakon or polystyrene embellished on an outer circumference 1 in. below the rim with a single glittering ring of embedded "rubies," "sapphires," "emeralds" and "diamonds" also moulded from the same material. Such an idea might go down well at Christmas parties and at some of the more colourful night clubs!

In continuation of our experiment in decorating melamine cups by hand painting and protecting the design so made by spraying with a synthetic clear lacquer followed by stoving, we have now carried out the decoration of the two melamine cups shown below. These have been "half"-cured (two minutes) by Ranton and Co., Ltd., presuming that better adhesion will be obtained between the cup and the lacquer. At this "half"-cured stage the cups have less gloss than the fully cured type.

Fig. 2. Black and white pen and ink sketch on melamine cup.

Fig. 3. Green motif on melamine cup. Both cups have been "half"-cured.

Pressure Bottles in Reinforced Plastics

The successful production of reinforced plastics pressure bottles for the aircraft industry has resulted in considerable weight saving without loss of strength.

LESS weight, more strength! That is one of the many problems which designers of aircraft have to face in order to increase the efficiency, speed and airworthiness of their products. Strength/weight ratios are probably more important to the aircraft industry than to any other industry and a pound in weight saved will mean an increased payload, greater range or greater fire-power. It is for this reason that the development of the plastics (glass fibre/epoxy resin) compressed-air storage bottle is being watched with great interest. A saving of over one-third is made in the weight when compared to the steel bottles now in use and, in addition to this appreciable saving, the danger from the shattering of a bottle and consequent risk to personnel from flying splinters can, for all practical purposes, be eliminated.

The Walter Kidde Co., Ltd., of Northolt, Middlesex, already well known in the aircraft and other industries as pneumatic engineers and manufacturers of fire-fighting equipment, have gone ahead with the development of these bottles and prototypes are being exhaustively tested by the manufacturers. Results so far show that these bottles are proving satisfactory in all ways, which is confirmed by the report that American jet fighters are already being equipped with them.

The method of manufacture is ingenious and appears relatively simple. Appearances, however, are deceptive! The first stage is the manufacture of a low-melting-temperature metal-alloy sphere the size of which is the internal size of the bottle. The sphere is cast in two halves, which are assembled together. Fig. 1 shows a sphere after this operation. The metal former, for that is the purpose of the sphere, is now covered with a rubber liner with light-alloy inserts for pipe connections. This liner is retained inside the sphere after completion to provide a completely porous-free section.

Fig. 1.—The metal sphere prior to winding operations.

The next operation is the winding of the glass roving on to the rubber. The glass fibre is supplied in yarn form. Fig. 2 shows the bobbins of glass fibre yarn mounted in the creel while being fed to the system. The yarns are collected together and fed through the resin bath over a series of guides and passed through wipers to remove surplus resin. To effect the curing of the resin, a catalyst or hardener is added. From the impregnating stage the yarn is led directly into the winding machine.

This machine, which has been specially developed for the process, winds the impregnated yarn on to the rubber liner covering the metal former. The pattern of wind is such as to ensure an even distribution of stress to absorb pressures and consequent strains to which the spheres will be subjected.

On completion of the winding, the sphere is transferred to the infra-red oven for curing or hardening (Fig. 3).

The final stage in the manufacture is the removal of the metal alloy former by injecting steam into the sphere. The metal is run off and the rubber liner is left in place, having been bonded to the glass fibre by the resin. Fig. 5 shows a cross-section of a completed sphere. The internal diameter is 12 in., capacity 900 cu. in., weight unfilled 16 lb., and the working pressure 3,000 p.s.i.

Testing Procedure

The rigorous tests to which the spheres are subjected provide substantial proof of the suitability of glass fibre and epoxy resin for this application. Each sphere is tested hydraulically to pressures of 1½ times the working pressure, that is 4,500 p.s.i.; pressure is then released and built up again to 4,500 p.s.i. and any expansion in diameter is measured. Other tests include an ultimate bursting test, which must not be less than 6,000 p.s.i.; a cycling test, which is designed to prove the life of the structure due to frequent changes in pressure, and a gunfire test. In the cycling test, pressure is raised hydraulically to the working pressure and then reduced to zero. This cycle is repeated at the rate of approximately eight per minute until the sphere bursts. It is expected that a life of over 20,000 cycles will be a standard figure. The firing of a .303 bullet at 25 yd. range through a light-alloy sheet which "tumbles" the bullet before it hits the charged sphere, is the basis of the gunfire test. There shall be no fragmentation of the vessel. The results obtained from this test have proved entirely satisfactory.

Pressure Bottles in Reinforced Plastics

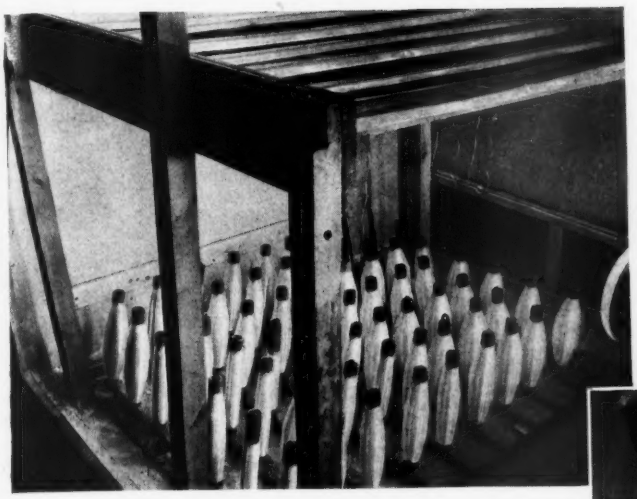


Fig. 2 (Above) Glass yarn prior to the resin impregnation.

Fig. 3 (Above) After winding the resin is cured by infra-red heating.

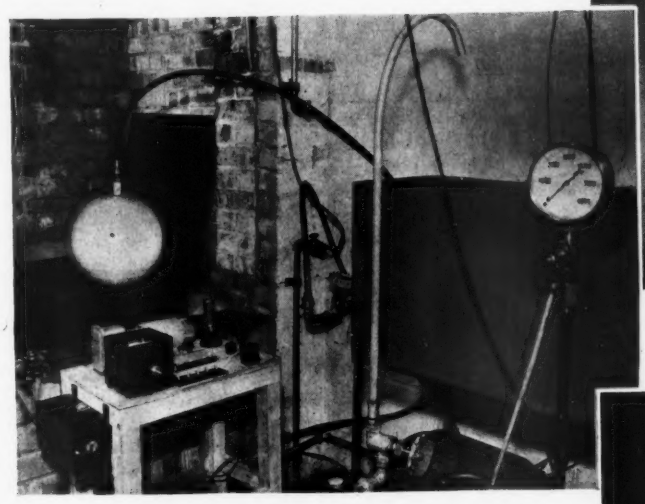


Fig. 4 (Above) Testing equipment. The cycling test apparatus can be seen in the foreground.

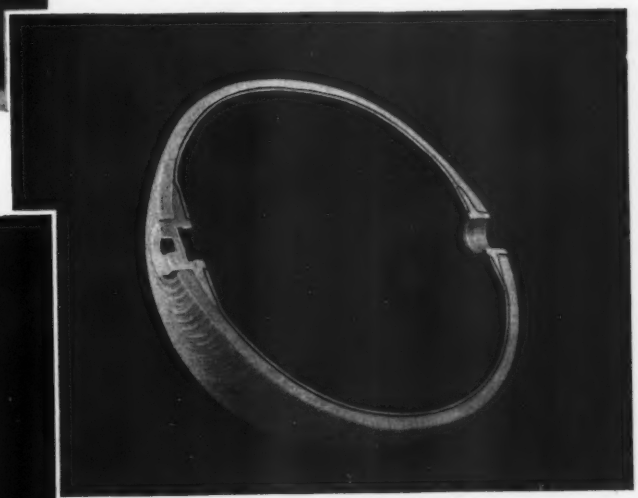


Fig. 5 (Above) A cross-sectional view of a sphere showing the rubber lining.

Fig. 6 (Left) The completed pressure bottle.

New Plant for the Production of Vinyl Acetate

Fig 1.
A general view of the new plant.

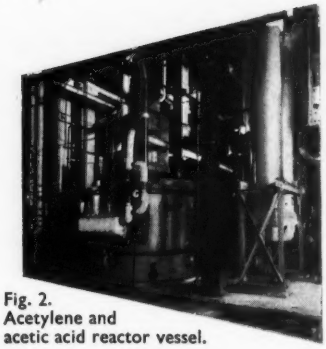


Fig. 2.
Acetylene and acetic acid reactor vessel.

NORTHERN England is again the scene of an important step forward in the progress of the plastics industry. Following the commencement of production at the I.C.I. Terylene plant, British Oxygen Co., Ltd., have now started producing polyvinyl acetate at Chester Le Street. This in itself is an interesting enough news item but what is more remarkable is that not only is the polymer produced here but also the vinyl acetate monomer. Previously the majority if not all supplies of the monomer have been imported from Germany and other countries and then polymerized in this country.

British Oxygen Co., Ltd., have long been established as suppliers of industrial and medicinal gases but it wasn't until after the last war that they entered the chemicals field. Their first venture was the production of melamine from the cyanamide, which was already being produced on the site. This is now a firmly established production unit of the company. The second venture, the polyvinyl acetate plant has been erected to take advantage of the acetylene production of which B.O.C. are one of the largest producers in this country.

The monomer of vinyl acetate is produced by the reaction of acetylene and acetic acid at a reduced temperature and in the presence of a catalyst. The type of catalyst used is of importance in that it controls the quality and the quantity of monomer produced minimizing the formation of ethylidene diacetate.

British Oxygen are fortunate in having the supply of acetylene on the site and it is piped direct from the production unit to the new plant where it undergoes purification before it is passed through the acetic acid and catalyst. The reaction which takes place produces a crude monomer and acetic acid. By distillation process the acetic acid is removed and returned to the reaction vessel and the purified monomer, now an unstable liquid, has a stabilizer added before being stored or polymerized. Without the stabilizer uncontrolled polymerization would occur with considerable risk from the heat generated.

Controlled polymerization for the production of polyvinyl acetate granules is obtained by the addition of a catalyst. The polymer produced being a viscous liquid which is extruded through a Marblé extruder on to a conveyor. Cold air circulation assists in the cooling and solidifying of the " laces " on the conveyor before they are fed into a granulating machine. Dust and light particles are removed and the final product drawn off into bags. The granulated polymer is then in a convenient form for handling and storage and can be dissolved in a variety of solvents. It is in itself 100% polyvinyl acetate.

Polymerization for the emulsion product varies slightly from the granule method in that in addition to the catalyst, emulsifying and thickening agents are added. These vary, depending upon the end-use for which the emulsion is intended. After the reaction is complete the emulsion is stored in tanks at a controlled temperature. The majority of polymer sold is in this form the biggest users being the paint and adhesives industry. When it is used in paints it improves coverage and adhesion, and is easier to apply. In the adhesive field the wide variety of materials which it will bond and the ease of its application has made polyvinyl acetate a popular cementing medium.

Safety Measures

Because of the highly inflammable nature of the raw materials and monomer, the monomer producing plant has been built in the open, and all controlling is carried out from a central electronic instrument room a part of which is shown in Fig. 4. This, like all the electric wiring on the site, is kept at a slightly higher pressure than atmospheric to prevent entry of explosive vapours and the risk of their ignition from an electric spark. The polymer plant is enclosed to avoid contamination by dust and to maintain a controlled temperature.

The plant cost over £500,000 to construct representing a capital outlay of approximately £10,000 per operative. Production capacity is not known but the unit is running seven days a week on three shifts.

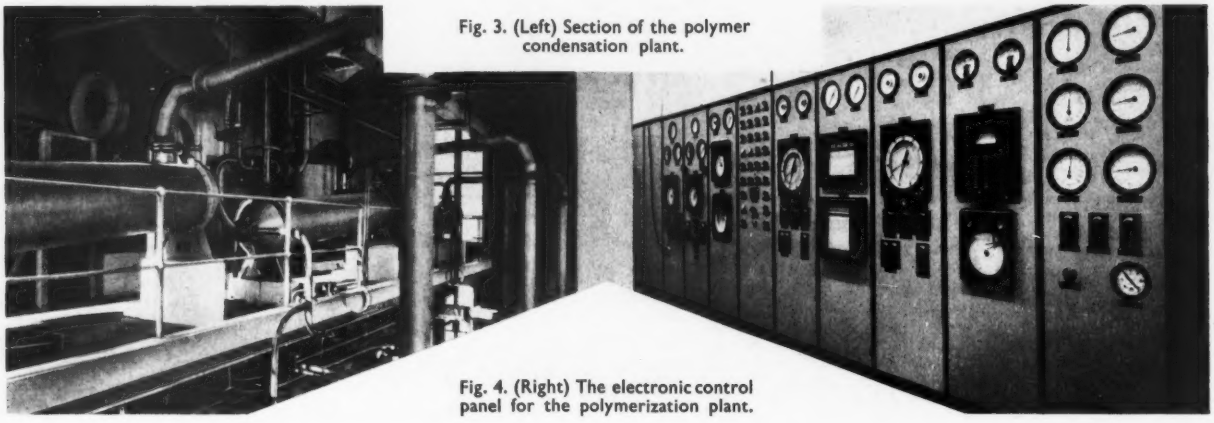


Fig. 3. (Left) Section of the polymer condensation plant.

Fig. 4. (Right) The electronic control panel for the polymerization plant.

Plastics and The Comb

Comb manufacturing is one of the earliest and at the same time one of the biggest single outlets for plastics materials. The following article describes the growth of one of our principal comb manufacturing companies, E. R. Holloway, Ltd., of Welwyn Garden City, Herts.

WHEN the history of our industry comes to be written, it will be to the common-or-garden comb that the author will point as the original plastics fabrication, for it was the intricate hair styles of the mid-19th century, relics of the Second Empire, that stimulated the search for a substitute for those most expensive commodities, horn and ivory. This year we celebrate the centenary of Parkesine (see *Plastics*, February, 1955, page 58), which was the precursor of Xylonite. Alexander Parkes, generally regarded as the founder of the British plastics industry, saw in Parkesine a material of infinite uses, and, with gutta-percha, both Parkesine and Xylonite, exercised a considerable influence on the comb-making industry.

For the origins of combs themselves, history is not old enough to tell; aborigines of New Guinea use today a rudimentary comb similar to prehistoric specimens in our museums, a leg bone of an animal split to the depth of about five inches, to give two prongs. At various times, combs have been made from wood, bone, bronze, silver, gold, tortoiseshell, and rubber. Some, like those in New Guinea, have been primitive in the extreme; others, particularly medieval specimens, were richly carved and jewelled.

Of all these materials, only tortoiseshell has remained as the basis for comb manufacture in any quantity. For the rest, the market for combs, has expanded rather than diminished, making use almost exclusively of plastics materials. Starting with celluloid, we have seen the widespread use of casein, ebonite, cellulose acetate, methyl methacrylate, polystyrene, culminating with one of the most successful materials of all, nylon.

Just how large is this comb market, may be judged from unofficial figures obtained from various sources in this country. World production for 1954 was estimated to be 120m. combs, Britain's share being in excess of 60m. It will be seen from these figures that only the tremendous mass productive capacity of the injection moulding technique can hope to make available large supplies of combs, at, in most cases, very low prices. Despite this fact, however, injection moulded combs are a relatively new innovation; their production in this country dates back to 1937 and their history is closely tied with that of E. R. Holloway, Ltd., of Welwyn Garden City, Herts. Holloway's were, in fact, the first to purchase an injection comb mould in this country.

E. R. Holloway, Ltd.

Two young men, working with a large perfumery manufacturer, conceived the idea, just before the 1914 war, of starting a fancy goods department. They started to import hair combs from France, Czechoslovakia and Germany, and the department thrived. The next development was the formation of a separate company, E. R. Holloway, which had its premises at that time in the centre of the fancy goods import business in Fore Street, in the City. It was at Fore Street that the company was capitalized and premises were afterwards found in Milton Street.

In the late 1920s the Government introduced an 8s. duty on imported combs, as a stimulus to the home manufacturing industry, of which even then a large part was devoted to ivory and tortoiseshell. As a result of this, E. R. Holloway

Fig. 1. View of injection moulding shop. The company has standardized on 8-oz. machines, and the shop layout, as will be seen, is designed to give maximum ease of working.

Fig. 2. A spray of combs is removed from a six-impression tool.

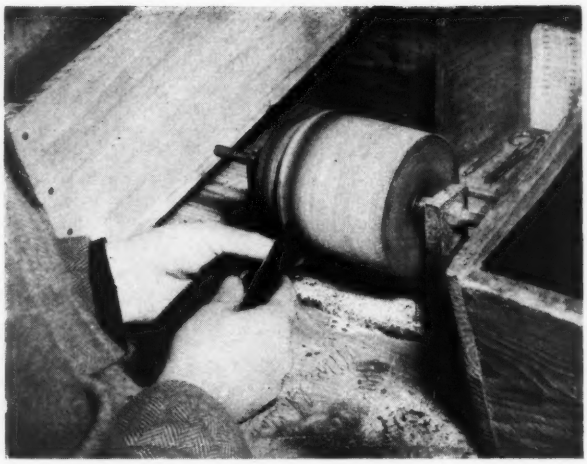


Fig. 3. Hand-buffing to remove roughness where sprue has been cut off.

moved to new premises, a small boot and shoe factory in New Southgate, adjacent to the large works of the Standard Telephone Co., Ltd. Here they started manufacturing their own combs, saw-cutting them from blanks which were purchased from the Continent, principally from Germany, and from America. The material used was vulcanite, and the company was working in conjunction with the Bolta Rubber Company, Massachusetts, U.S.A. In 1936 the directors bought out the Bolta interest in the business and established a factory in Welwyn Garden City. Until this time, therefore, the comb manufacturing activities of the company were concerned exclusively with vulcanite as the raw material. It was in 1937 that the company purchased an Isoma injection moulding machine and thus pioneered this branch of the plastics industry. Today, the company is one of the most active and expanding in this field, although it has now many other ramifications, and markets the largest range of combs in the world.

Comb Manufacture

The technique of comb manufacture will be familiar to the majority of our readers. Precision tools are the first requisite, since even the lowest price comb must conform to rigid standards. Both cellulose acetate and polystyrene, the two most widely used materials today, are relatively simple to mould, demanding only efficient plant. Preheating techniques are, of course, employed since these contribute greatly to low rejection rates and strain-free products. Strain is one of the most frequently encountered problems in the injection moulding of combs since the material, leaving the sprue in a molten state, has to travel the length of the spine of the comb and at the same time run to the end of each tooth cavity. Control of this problem is greatly assisted by the use of polarized light, a visual means of identifying strain, and where it does occur, strain is usually to be found at the end of the comb, away from the gate. A general view of the injection moulding shop of Holloway's subsidiary, the Barnet Comb Co., is shown in Fig. 1.

Injection Moulding

With the aid of modern injection machines, semi-skilled labour can take charge of the majority of operations including that of sprue and runner removal, which, if carried out skilfully, dispenses with any extensive finishing operations. Of all materials used today, nylon probably gave most difficulties in the early stages of development. There are now, however, generally accepted techniques by means of which the majority of these have been overcome. The maintenance of a set cycle related to a known optimum barrel temperature is probably the most helpful.

1937 also saw the building, at a separate site in Welwyn Garden City, of a raw material organization, designed principally to serve the needs of the parent moulding organization.

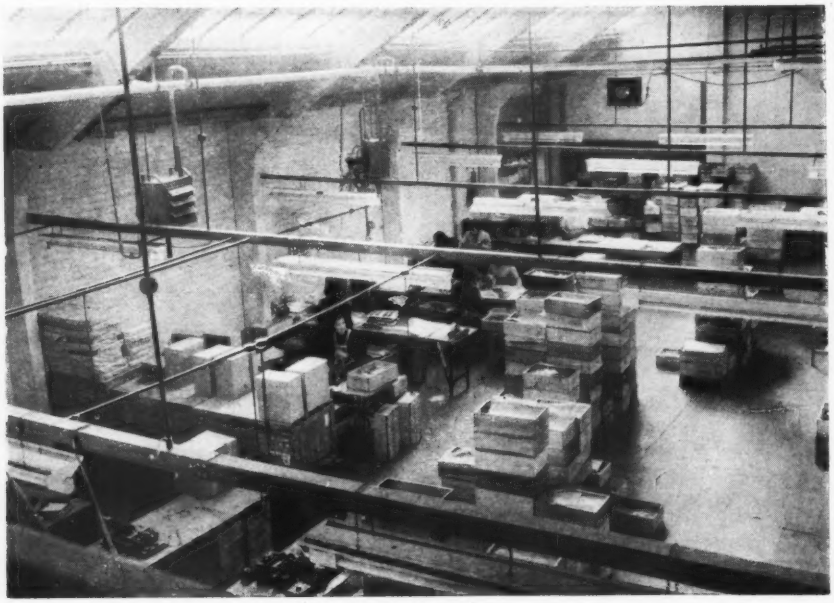


Fig. 4. A view of the sunglass packing department. The company's buildings are modern and light.

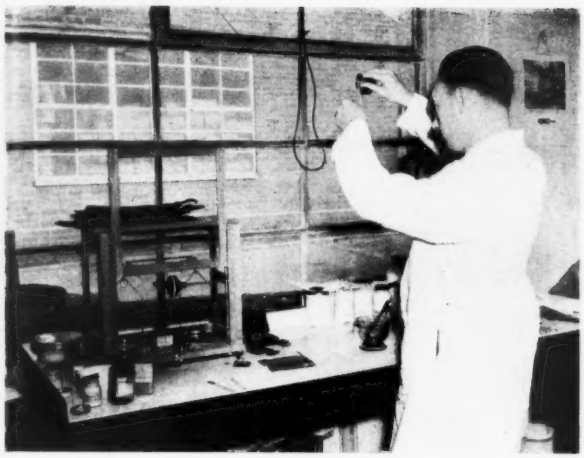


Fig. 5. (Left) A chemist testing samples in the laboratory of Lustrac Plastics, Ltd.

Fig. 6. (Right) Cellulose acetate compound is shown here being worked on a hot mill.

Known as Lustrac Plastics, Ltd., this division of the company is primarily concerned with the manufacture of cellulose acetate moulding powder. By the combination of acetic acid and anhydride and cellulose, in the presence of a catalyst, the cellulose acetate itself is prepared, plasticizers and colouring agents being incorporated. Typical plasticizers used are such materials as dimethylphthalate and triphenyl phosphate. The combined material is then extruded, the extruded strips being segmented by means of a cutting machine. Whilst Lustrac continues to meet the requirements of the parent company, its activities have also been expanded as a major raw material manufacturing concern, selling powder to the trade both in this country and abroad.

Lustrac is also responsible for the colouring of other moulding compounds, such as polystyrene and nylon. This enables the company to effect bulk purchase of virgin powder and then to colour and mottle as called for by the moulding plant.

As might be expected, the parent organization has expanded its activities in the fancy goods field to a very considerable extent. The injection moulding programme includes a considerable quantity of sunglasses, and in a smaller way, but equally important, the company markets a wide range of mouldings, in large quantities, to the trade. A later development has been the setting up of a separate factory dealing with the fabrication of p.v.c. sheet by means of high-frequency welding. Here products including comb cases, vanity cases, manicure sets and wallets are manufactured.

Developments have, therefore, been substantial since the early work of the original partners, Clark and Holloway, and today, the group of companies employs over 500 people. As an organization it has its links with the earliest of plastics manufactures, the hard rubber comb, can take pride in pioneering the first injection moulded comb in Great Britain, and is today in the course of substantial expansion in the field of fancy goods.

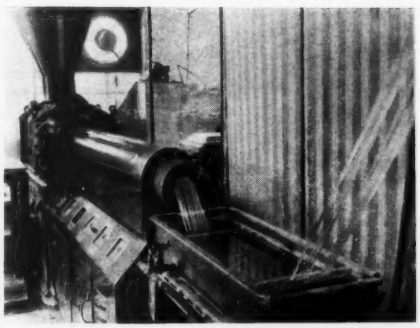


Fig. 7. (Left) Polystyrene colouring by means of extrusion.

Fig. 8. (Right) A bay in the sunglass assembly shop.

Fig. 9. (Left) High-frequency welding machines used in the fabrication of p.v.c. sheet.

Fig. 10. (Right) Gold-blocking on p.v.c. welded fancy goods.

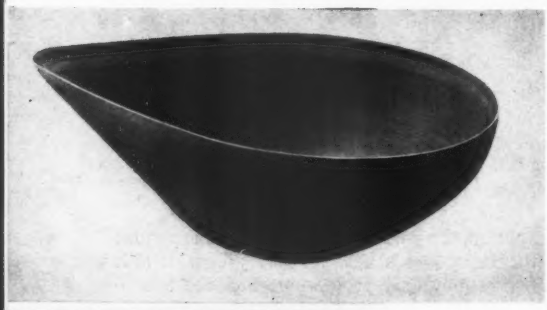
PLASTICS
IN THE SERVICE OF MAN

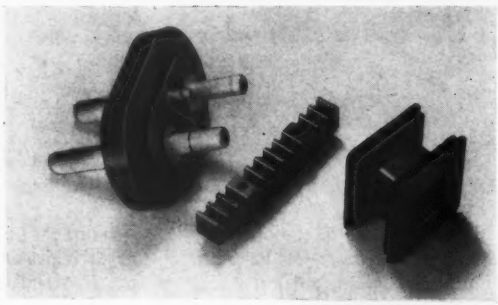
A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

55. The Fighting Services - II

A list of trade-marks and companies mentioned in this review, with full names and addresses, appears on page 89

(Above) Three course meal tray designed by Gaby Schreiber for use in R.A.F. canteens pressed from acrylic sheet by Runcolite Ltd. (*Plastics*, 1951/Mar./69.)

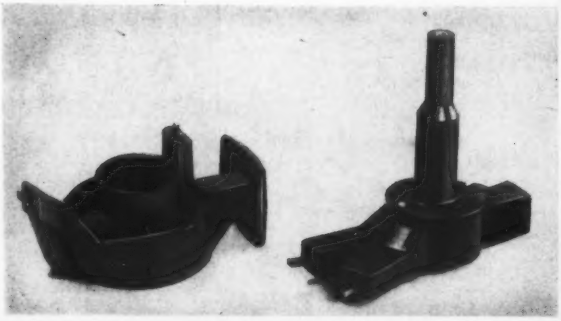




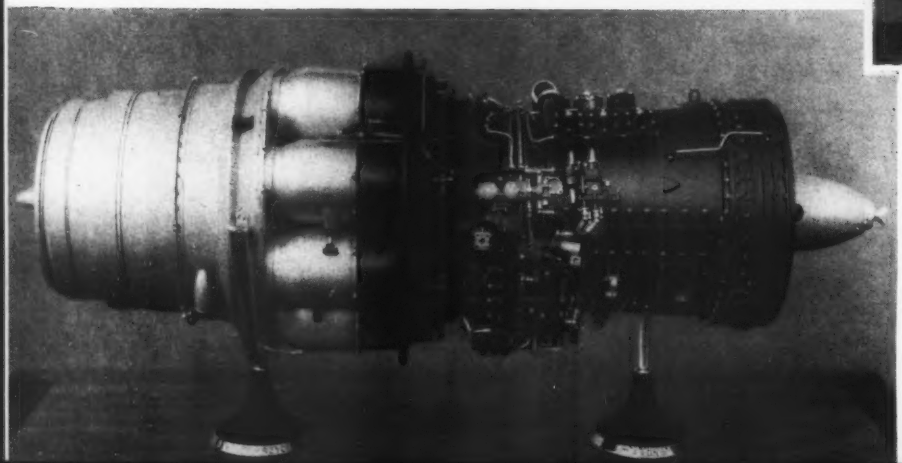
(Left) (1) Plug base moulding in general purpose phenolic; (2) Terminal block (11 way) in phenolic by courtesy of R. B. Pullin & Co., Ltd; (3) Coil former in nylon-filled phenolic by courtesy of Pamphonic Reproducers Ltd. All moulded by Metropolitan Plastics Ltd.

(Top left) Plastics radome used by Fairey Aviation Co., Ltd., on the "Barracuda."

(Left) Bearing moulded from Bakelite shock resisting material by W. H. Tant & Co., Ltd., for Turner Manufacturing Co., Ltd., and used on Service lorry 5-ton winches.

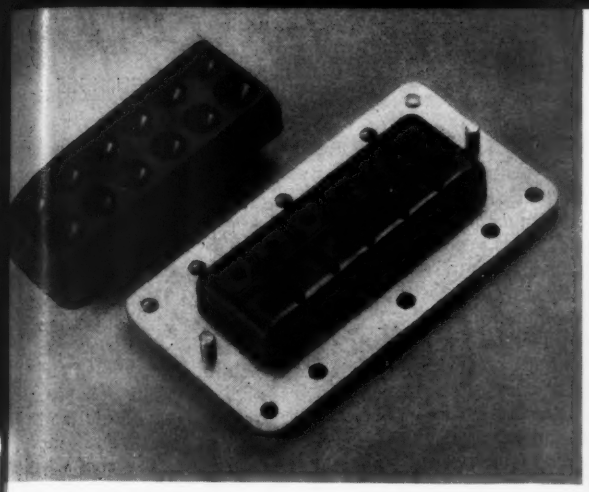


(Right) Magneto distributor rotor and sleeve in wood flour-filled phenolic and rotor wheel in mica-filled phenolic moulded by Rotax Ltd.



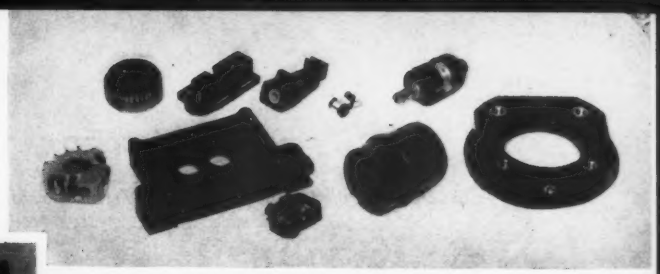
(Above) Experimental aircraft wing made from phenolic resin bonded asbestos felt shown at the 1952 B.I.F. (*Plastics*, 1952/June/159.)

(Left) Model of Rolls-Royce Avon jet engine in Perspex (with the exception of spinner and combustion chamber) made by Shawcraft Models. (*Plastics*, 1954/Feb./55.)



(Above) Insulator head and base in nylon filled phenolic manufactured by Metropolitan Plastics Ltd.

(Right) Moulded and extruded p.v.c. used in a hand microphone moulded by J. F. Kenure and Co., Ltd. (*Plastics*, 1947/June/9.)



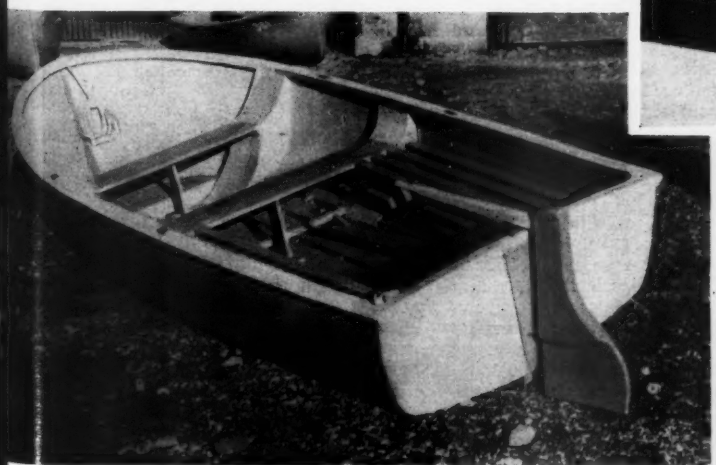
(Above) Electrical equipment moulded by Rotax in cotton, rag, cotton graphite, and wood-flour filled phenolic and mica filled melamine materials.

(Above) Perspex navigational aid made by Starkie Gardner Ltd.

(Above) A stage in the manufacture of a glass fibre resin-bonded radome at Bristol Aeroplane Co., Ltd.

(Left) Bakelite glass filled phenolic moulding used for the canopy fairing of the Hawker-Hunter moulded by H. Comoy and Co., Ltd.

(Below) Testing glass fibre radomes for the de Havilland "Venom" night fighter.



(Above) Resin-bonded Fibreglass dinghies for the R.A.F. built by W. & J. Tod Ltd.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

" Plastics in the Service of Man "

SIR,—For some time past I have been getting your excellent magazine, with its wealth of information, through your agents. As an overseas reader, I wholeheartedly agree with the comments expressed in the editorial of your January issue. The feature " Plastics in the Service of Man " is an excellent means of propaganda, especially to those people who are interested in the plastics industry. Is it possible to obtain back numbers of this feature dealing with tableware, kitchen equipment, toys and other consumer goods? I would also like to obtain a copy of the Export number of *Plastics* issued in May last year.

I am particularly interested in representing British plastic manufacturers in this country. I feel that there is a tremendous market here for certain plastic goods.

S. SOLOMON.

P.O. Box 7374,
Johannesburg,
South Africa.

Printing on Thermoplastics Sheet

SIR,—Could you give us the names of manufacturers of hand-operated machines for printing on thermoplastic sheeting such as p.v.c., etc., or a supplier of suitable spray-type gun and paints using compressed air and spraying over stencils and the material.

BERG AND COMPANY.

33 Salt River Road,
Salt River, C.P.,
South Africa.

Plastic Bobbins or Reels

SIR,—We are wondering whether you could put us in touch with a firm, preferably in the south of England, who could supply plastic bobbins or reels.

NATHANIEL LLOYD AND CO., LTD.

Burrell Street Works,
Blackfriars,
London, S.E.1.

Polythene-coated Tape

SIR,—We have developed a special-purpose tape consisting of a woven fabric coated with polythene, which in the experimental stages was produced by coating a 36-in.-wide material, and then slitting down to ¼-in. widths. We are now faced, however, by a production difficulty which is based mainly on the question of quantity. The firm of coaters which kindly co-operated in producing a very short experimental run of some 200 yards of 36-in. coated fabric inform us that it is only practicable for them to coat fabric in runs of 10,000 yards and upwards, which quantity, converted into ¼-in. strips, would be greatly in excess of the quantities we would require.

The alternative economic method of production in our opinion would be for us to weave a ¼-in. fabric tape in runs of approximately 50,000 yards, and have this coated with polythene, but here we have encountered the problem of finding a firm with the facilities for coating such a narrow width of fabric.

Any useful suggestions which you or your readers may be able to offer would be greatly appreciated.

BANTEX, LTD.

186 Walmer Road,
London, W.11.

Injection Moulding

SIR,—We would be grateful for information of a hand-operated injection-moulding machine capable of producing plastic labels 5 in. by ½ in. by .030 in., at the rate of 400-500 per hour.

The A.P.M. 2/3-oz. moulding machine, whose advertisement appears in *Plastics*, is the type we have in mind, but this machine has a maximum capacity of 2½ in. only. We wonder if there is a larger machine available? If so, could you inform us of the manufacturer's name and address, please.

MESSRS. MUSKETT AND WHITE.

31 Rocklands Drive,
Stanmore,
Middlesex.

Polytrichlorfluorethylene

SIR,—On page 6 of the January, 1955, issue of *Plastics*, you mention that the firm of Péchiney in France are in the process of manufacturing a new polymer, polytrichlorfluorethylene. Can you give us any details on the availability and properties of this polymer, and the French address or the British Agency?

Yeovil, NORMALAIR, LTD.
Somerset.

Injection Machine Required

SIR,—We are requiring an injection machine and have been in touch with a company who make a small hand injection press which is not quite large enough for our purpose. We would appreciate it if you could put us in touch with a firm making the larger type. We need to inject mouldings up to 30 grammes.

BAXTER WOODHOUSE AND TAYLOR, LTD.

Woodside,
Poynton,
Cheshire.

Allyl Methacrylate

SIR,—We are anxious to locate a source of supply of the allyl compounds with particular reference to allyl methacrylate. In this connection we should be grateful for any names and addresses you can forward to us.

METRODENT LTD.

78 John William Street,
Huddersfield.

Book Reviews

Protective Wrappings, by C. R. Oswin, M.A., F.R.I.C.

Published by Cam Publications, Ltd., 311 Grays Inn Road, London, W.C.1. Price 32s.

At a time when packaging is receiving a good deal of attention it is a fortuitous moment for the publication of a work on one aspect of this industry. Mr. Oswin has written and compiled a treatise on the various properties, uses, and methods of testing, for film wraps and foils. He has dealt with the subject in a manner which is both thorough and interesting and will provide the consumer of film with a knowledge of the material, its properties and idiosyncrasies.

The book commences with a simplified chemical analysis of the structure of the basic film materials and goes on to give details of the methods of testing in the laboratory which have been found most successful in determining the properties of various films. Linked with the laboratory performances are the complementary mathematical Quantitative theory, and also Qualitative extensions, the former being a theory for selecting the most suitable wrappings for water-sensitive goods, and the latter a method of assessing the protection given by film, against various deteriorating agents.

Dust is Dangerous, by C. N. Davies, D.Sc.

Published by Faber and Faber, Ltd., 24 Russell Square, London, W.C.1. Price 21s.

The profound importance of an unassuming dust particle in the lives of an industrial community has, in recent years, received an increasing amount of public attention. This is probably due to the inconvenience it has caused when one is trying to get home through smog, but to many people, including Doctor Davies, dust and fumes have been the basis of a serious and thorough investigation. The methods adopted and counter-measures suggested have now been published. It makes both interesting and forbidding reading and brings into the open the dangers to which employees are exposed by inadequate exhaust ventilation.

Dust is a hazard in so many industries that it would be impossible to segregate the many different problems arising and because of this a general picture of the research is given. From this the reader will have the conviction that dust *is* dangerous.

Developments in the Moulding of Sheet Perspex

Clearex Products Ltd. was formed in 1945, and from the outset specialized in the fabrication of sheet Perspex. This article is a record of ten years of progress, during which many new techniques have been developed. Of special interest is the "crush" moulding process which appears to hold great possibilities for the future, since it offers considerable economies, both in plant cost and product finishing.

Fig. 1. This biscuit barrel was one of the first productions of Clearex, and was made by saw-cutting and cementing Perspex.

THE late war provided a tremendous stimulus to all forms of plastics, particularly to polythene, polystyrene and polymethylmethacrylate. Large numbers of people, to whom plastics were unknown substances hitherto, gained valuable experience in their manipulation and fabrication. It was, therefore, natural that many, fascinated by the special properties of these newer plastics, should plan a peace-time business career in which these materials would play some part.

Unfortunately, many launched forth, limited in capital, unprepared technically to handle plastics; even simple cutting and shaping, with tractable plastics such as Perspex, demands not only a knowledge of the material, but also knowledge of fabricating methods and machinery, if economic production is to be attained. A very large number of men and women found themselves in deep water, their difficulties increasing as economic conditions hardened, into the severe recession of 1949-1950.

It is, therefore, very pleasing to be able to describe the activities of a small group of people who successfully weathered this difficult period, and who, from very small beginnings have today directorial responsibility for a company capitalized at £15,000.

Clearex Products Ltd., was formed in 1945, and had as its premises a shop in Wembley. The sole equipment was a power-driven rotary saw, plus technical skill on the part of the members. An example of the company's early work can be seen in Fig. 1, a biscuit barrel; in the early days production consisted exclusively of fancy goods cut from sheet Perspex and fabricated by heat treatment and cementing.

Perspex remains the principal material handled by the company, but extensive developments have been made both in techniques and range of applications, with the result that from the original premises the company is now housed in two blocks in Heather Park Drive, Wembley, together covering some 10,000 sq. ft.

Sheet Moulding

The major developments have been in the field of sheet moulding and "crush" moulding, both of which have largely involved original designs by Clearex directors.

This technique bears some resemblance to vacuum forming

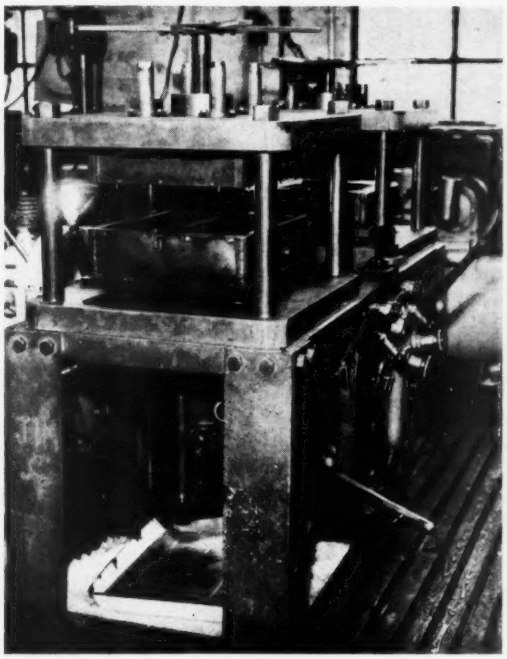


Fig. 3 (above) Dashboards for the Hillman Minx on the finishing line.

Fig. 2 (left) Sheet moulding press designed and built by Clearex

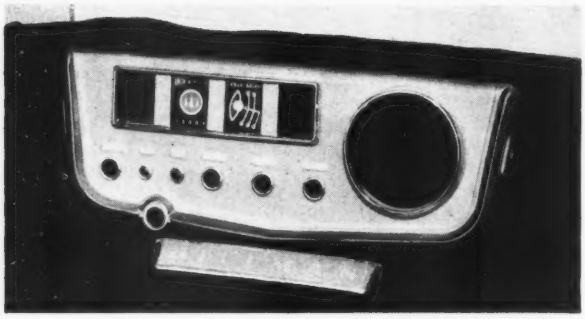


Fig. 4. A close-up view of the Minx dashboard. As will be seen, they are despatched in an almost completed state.

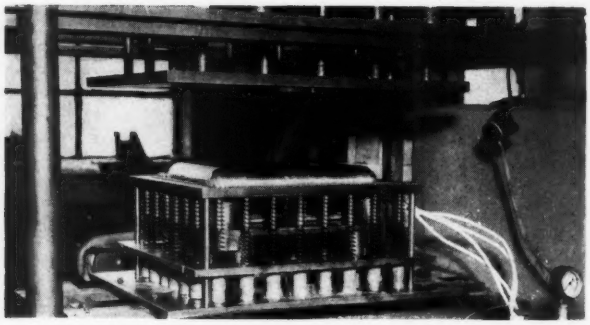


Fig. 5. This hydraulic press is used for moulding deep-drawn articles, and the tool shown produces a food container in Perspex for Scribbans-Kemp.

and low-pressure moulding. The special presses comprise a box into which pre-heated acrylic sheet is vacuum-drawn, being retained at the edges, the punch which has no lateral movement and rises and falls on a screw thread, a vacuum pump and a compressor. A general view of the machine can be seen in Fig. 2. This press was designed and built by Clearex Products Ltd.

For the manufacture of dashboard fittings for cars, the shells are usually made in tandem. Sheets 3/16-in. thick are pre-heated to 140° C. in an oven, and then placed over the box, held in position by means of a retaining ring. The sheet is then vacuum drawn down into the box, vacuum pressure being applied by means of a jack-ram. Since the sheet is being drawn free there is no uneven thinning, a very important feature of the process.

The punch is then screwed down into the box until it comes into contact with the sheet. Pressure on the sheet, however, is not applied by the punch. The vacuum is then cut-off and positive pressure applied to the underside to blow the sheet over the punch.

Since the sheet has already roughly assumed the shape of the punch, this last phase again does not thin the sheet, but merely registers on the sheet the detail recorded on the punch. The product is a remarkably strain-free unit, which will not warp, twist or craze, and which can then be silk-screen printed and/or metallized, after which it is ready for the assembly section seen in Fig. 3. An excellent example of a product of this technique is shown in Fig. 4. This Hillman Minx dashboard is moulded in pairs in Perspex.

In Fig. 5 is shown a hydraulic press of the traditional type used for deep drawing Perspex.

"Crush Moulding"

This process again makes use of acrylic sheet. The principal features of a screw press, also commonly known as a fly-press (see Fig. 6) will be known to most readers. The pressure is inserted through the screw and is dependent upon that of the lever, attached to the screw, the pitch of the screw and the force applied to the lever. A force of 100 lb. acting on a lever 20 in. long, which is attached to a screw having a

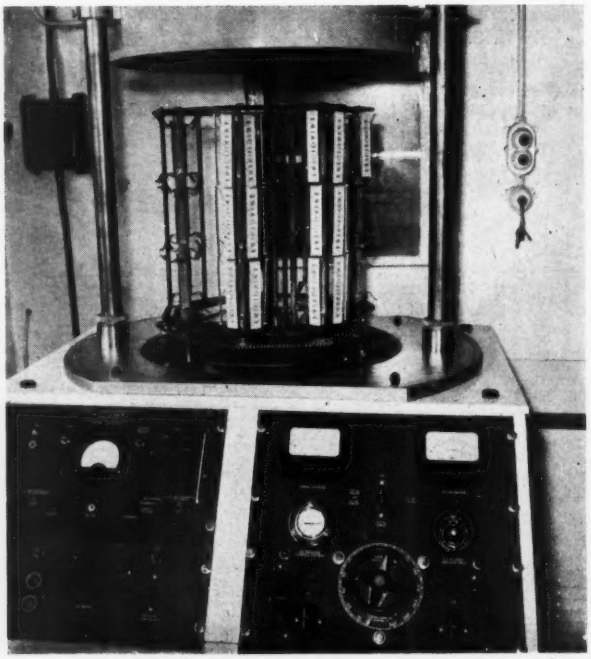


Fig. 7. (above) Vacuum metallizing machine with crush moulded name plates in position ready to be coated.

Fig. 6. (left) A typical fly-press. A pre-heated sheet of Perspex is seen in position over the mould cavity.

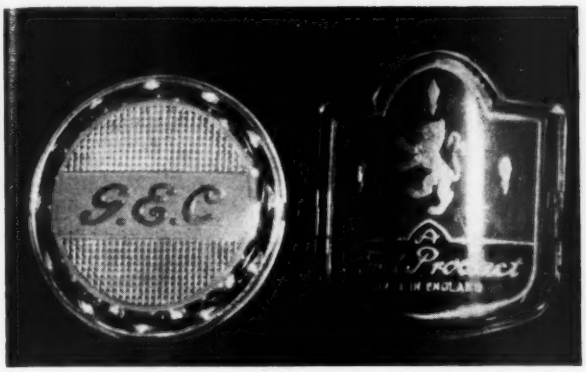


Fig. 8. (Above) Nameplates for G.E.C. and Fords, crush moulded in perspex.

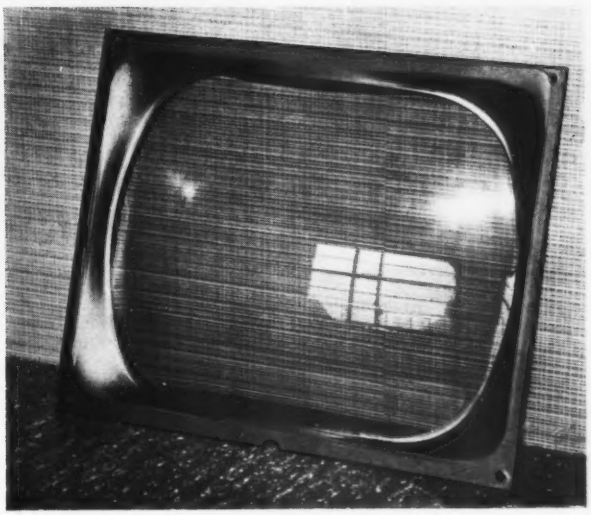


Fig. 9. (Right) Television surround in p.v.c.

pitch of ½ in., exerts a pressure of approximately 5½ tons. Fig. 6 shows a typical fly-press developing up to 15 tons pressure. The company is now working on a range of power-driven screw presses, the first of which is shortly to go into production.

Many components are ideally suited to the crush-moulded technique; refrigerator plaques, three-dimensional badges and decorative buttons are three typical examples of the kind of work that can be carried out with the aid of a low-cost press and relatively cheap tools. Examples are shown in Fig. 8. In this instance, the company is specializing in three-dimensional badges, supplying them to motorcar manufacturers, refrigerator manufacturers and the like. It is a field of technology which is obviously open to great development, since mouldings are not limited to flat shapes. In Fig. 10 can be seen a bulb-cap used in air-sea rescue apparatus, having a depth of about 1½ in. In addition, inserts can be moulded in, particularly valuable for threaded bolts for fixing plaques and badges. This latter technique patented by Clearex. Finally, products of crush moulding are of excellent finish, and, due to the absence of sprues and runners, require no post-moulding operations.

As with sheet moulding, the Perspex blanks are pre-heated in a small oven adjacent to the press, and for a three-dimensional badge of diameter of 3 in., the moulding cycle can be maintained comfortably at 35 seconds. The replacement of hand-operated machines by power presses will significantly increase production rates.

Vacuum Metallization

To serve the extensive market for three-dimensional badges, the company has installed two vacuum metallizing plants, the first manufactured by Vacuum Industrial Applications Ltd., and the second an Edwards machine. Both in painting and metallizing, the crush-moulding technique is remarkable for producing a strain-free product, with complete absence of crazing. A vacuum metallizing plant is shown in Fig. 7. This is the Via-Vac machine, and crush moulded refrigerator name-plates can be seen in position, preparatory to being metal-coated.

This feature reduces the rejection rate to an extremely low level, and it may well be that the mechanics of the operation are more satisfactory from the point of view of a strain-free product than, for example, injection moulding.

This will be evident from the examples in Fig. 8. Both these nameplates are typical examples of the crush moulding process, and required no finishing operation, apart from routine inspection, before dispatch to the customer.

In Figs. 9 and 10 are shown samples of other aspects of the work of Clearex. P.v.c. is used for the fabrication of television screen surrounds.

The company, whilst retaining its prime interest in acrylic compounds, is continually experimenting with fabrication techniques. No small credit is due to the original directors who, despite the many difficulties that arose, brought this company to the point it has reached today.

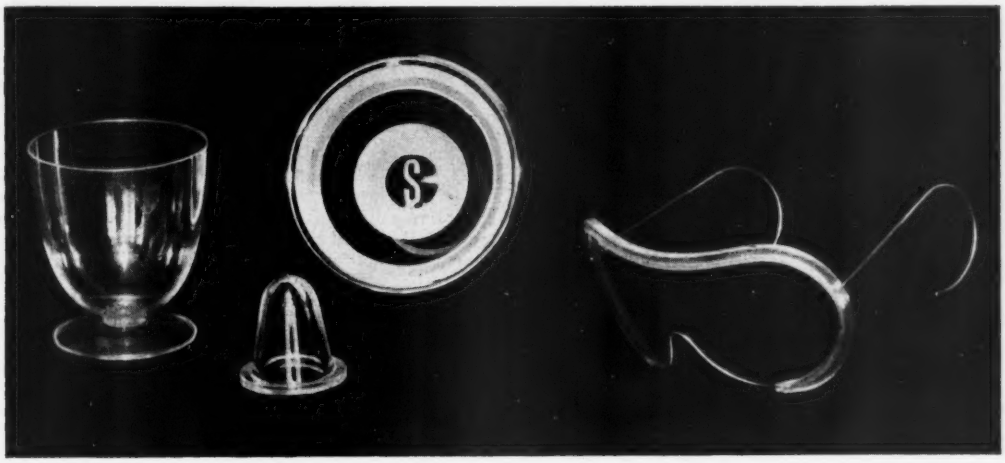


Fig. 10. Examples of typical Clearex productions. On the left is a wine glass for B.O.A.C. and next to it a bulb-cap designed for use with air-sea rescue apparatus. In the centre is a motor car accessory, and on the right are industrial protective goggles.

Alkyd Moulding Compounds for Electrical Insulation

By G. Bell and J. A. Willey, B.Sc., A.R.I.C.*

Handling alkyds in the press-shop is described in terms of low moulding pressures, rapid rate of cure giving high productivity, preforming, mould release and tool design. The electrical and physical properties of alkyd moulding are discussed. Applications of the new moulding compounds are envisaged in the light of American practice.

AT the American National Plastics Exposition in 1948 a small, air-operated press produced thermoset mouldings in eight seconds—mouldings, moreover, with top-quality electrical insulation values. A new concept in thermosetting moulding techniques had been introduced and with it the first of the now well-known range of Plaskon alkyd moulding compounds. These compounds are now to be manufactured in England under licence to Barrett Division, Allied Chemical and Dye Corporation, in a new plant coming into operation this month.

These alkyd compounds are quite unique in their moulding characteristics and should not be considered in the same light as the conventional urea, melamine or phenolic powders. Basically, they are unsaturated polyesters which cure by an exothermic, addition polymerization in the mould cavity: no volatile by-products are evolved, and this not only simplifies tool-design considerations as regards venting, but also largely accounts for the low moulding pressures, the ultra-rapid curing characteristics and the excellent electrical properties of the finished mouldings.

Moulding Technique

Alkyd will be available, in this country, in three physical forms, granular, putty and glass-filled.

The new moulding technique is not difficult and, indeed, it has many obvious advantages from the moulder's point of view, including a high rate of production on simple presses with commensurate savings in capital expenditure, tooling, maintenance and labour costs. Success in handling alkyd, however, very largely depends on an appreciation of the fact that the rate of cure is measured in seconds and, as soon as the material in the mould cavity reaches a certain critical temperature, an extremely rapid curing reaction begins. This reaction, once initiated, proceeds quite independently of the tool temperature and, since it cannot be stopped, there is much less risk of undercured mouldings. Mould temperatures in the range 275-330° F. may be used with a preference for the closer limits, 300-320° F. The speed of cure at these temperatures is illustrated in Table 1, where minimum cure times are given for discs of various thicknesses.

TABLE 1—Minimum cure times of alkyd moulding compounds (in seconds)

Temp. °F	Thickness			
	⅛"	¼"	⅜"	½"
270	25 (42)*	50 (70)	82 (114)	124 (160)
280	21 (36)	47 (61)	78 (101)	120 (140)
290	18 (33)	44 (53)	74 (90)	114 (122)
300	15 (29)	40 (46)	68 (80)	106 (107)
310	12 (25)	36 (40)	62 (70)	96 (96)
320	10 (20)	30 (35)	56 (60)	85 (87)

* Figures in parentheses refer to glass-filled alkyd

Undercure is a rather uncommon defect with alkyd mouldings and is, generally, only encountered in cases where an exacting time cycle is being followed with minimum cure times. Although not apparent by visual observation, the state of cure can easily be detected with a hardometer, such as the Barcol Impressor, taking readings before and after boiling in water for one hour. Precautions have to be taken, however, as *pre*cure, which can cause porosity in the finished moulding, is a common source of trouble with moulders who lack experience in handling the new alkyd compounds. Unless the press is closed rapidly, say within four seconds in the case of the granular or putty types and perhaps eight seconds with the glass-filled alkyd, precure may take place. Subsequent application of high pressure is of no avail if precure has occurred and may result in damage to the tool. On the other hand, there is no risk of *over*curing alkyd because the heat resistance of the mouldings is greater than the moulding temperatures.

Since there are no volatile by-products from the alkyd polymerization, and the material in the mould cavity passes through a momentary plastic or semi-fluid phase during the moulding cycle, only low pressures are needed to form the desired shape. High pressures may cause excessive flashing and, therefore, short mouldings as well as unnecessary mould wear on long runs. The following pressure ranges are recommended for average draw tools:—

	lb./sq. in.
Granular types (A.M.C.420, 422)	800-1,200
Putty types (A.M.C.411, 417)	200-600
Glass-filled (A.M.C.440A)...	1,200-2,000

The putty types are particularly interesting because the very low pressures required allow for moulding around delicate, electrical inserts which may, otherwise, be crushed or distorted at high moulding pressures. Actually, these materials were originally developed for use in the capacitor and resistor trades, where very fine wires and glass inserts are involved.

Special fast-closing presses have recently been developed to take advantage of the rapid-curing, low-pressure characteristics of the alkyd moulding compounds, and descriptions have been given in the literature of both a hydraulic[1] and an air operated press.[2] For some applications conventional presses have been modified to mould alkyd quite successfully.

The alkyd compounds, in general, have good release properties and no lubrication is necessary to ensure ejection from the mould. Where a tool has been running on phenolic powders, however, it must be thoroughly purged before attempting to mould alkyd. This may be achieved by running a few charges of urea or melamine before the alkyd is introduced or, alternatively, by a liberal application of a silicone grease or zinc stearate during the first few alkyd lifts. In changing back from alkyd to phenolic, the same procedure should be followed. It may be noted that contamination of alkyd by a phenolic compound, even in minute quantities, inhibits the cure.

Granular alkyd, with a bulk factor of 2 : 1, pellets very easily, using about one-quarter of the pressure normally required for conventional, thermosetting powders, and is suitable for volumetric feeding on fully automatic presses. The putty types (bulk factor *ca.* 1 : 1) are usually preformed by cold extrusion, but the high bulk factor of the glass-filled alkyd, namely 6-9, makes some kind of preforming almost essential. It is generally done by simple hand compression after warming for about 10 minutes in an oven at 130-140° F. Preheating alkyd, in the accepted sense of the term, should be avoided because the rate of cure is so rapid that there is little to be gained; indeed, there is a very grave risk of precuring before the material is even in the mould.

The granular and putty forms of the new alkyd compounds are not really suitable for transfer moulding. In some special cases the transfer technique has been used successfully, but the extremely fast curing characteristics preclude multi-cavity tools interconnected with long or complicated runner systems. Relatively small parts may be transfer moulded, provided the designer allows very short open runners, liberal gating and single rather than multiple gates per cavity. On the other hand, the glass-filled alkyd is an excellent transfer material, provided care is taken in the design and filling of the tool to avoid alignment of the fibres. Even in normal compression moulding there is a tendency towards loss of strength by fibre alignment but, when correctly moulded, glass-filled alkyd has an Izod impact strength of 8-12 ft./lb. per inch of notch, which is higher than that of conventional thermosetting moulding compounds.

*Resinous Chemicals, Ltd.

Mould Design

The high rate of production with alkyd combined with its low moulding pressures have many advantages for the tool designer. Fewer cavities are needed for any given daily production and the tools need not be so robust as when conventional powders are used. The economics of the alkyd moulding process has already been discussed,[3] with particular reference to the American products which are to be manufactured in England and which form the subject of this article.

Although both the granular and putty alkyds have mineral fillers, the low moulding pressures entail much less wear on moulding tools than the mineral-filled melamine or phenolic powders. Chromium-plated flash or semi-positive tools are recommended and the normal precautions for designing should be followed, namely, flowing curves and generous radii, rather than sharp corners, avoidance of thin sections (less than $\frac{1}{16}$ in.) and narrow projections, and the provision of suitable tapers. Clearances are normally 3-4 thou. with putty materials, 4-5 thou. for the granular types and 6-7 thou. for glass-filled alkyd.

It should be borne in mind that the alkyd moulding compounds have virtually no after-shrinkage and, although this is of particular value for mouldings which must maintain a constant fit or size over a long period of time under varying conditions of humidity, inserts present rather unusual problems. The absence of after-shrinkage eliminates a factor which is often relied upon to bind inserts into the moulding more tightly as time elapses. Inserts, therefore, should be provided with generous knurls or undercuts to ensure good gripping.

Electrical Properties

At one time materials used in electrical work were loosely classified as either "conductors" or "insulators." Modern requirements, however, have imposed many limitations on the value of an insulator which have considerably narrowed down the field of materials from which a choice might be made. Still pre-eminent are the hydrocarbon polymers, such as polythylene and its fluorinated derivatives, but the alkyd moulding compounds show the best all-round electrical insulation properties of the thermosetting plastics.

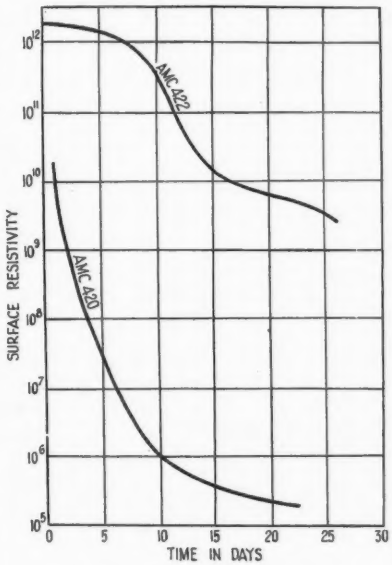


Fig. 1. Surface resistivity at 71°C. and 100% R.H.

The outstanding arc resistance and anti-tracking properties of alkyd are at least as good as, and probably even better than, mineral-filled melamine, which is, itself, much better in these respects than either phenolics or ureas. Self-extinguishing grades of alkyd are also available to further enhance the anti-tracking properties by ensuring that if combustion did occur under abnormally severe operating conditions, the apparatus would not catch fire.

The dielectric strength of alkyd mouldings, which is a measure of the ability of the insulator to resist breakdown under an applied voltage, is equivalent or superior to any other thermosetting plastic.

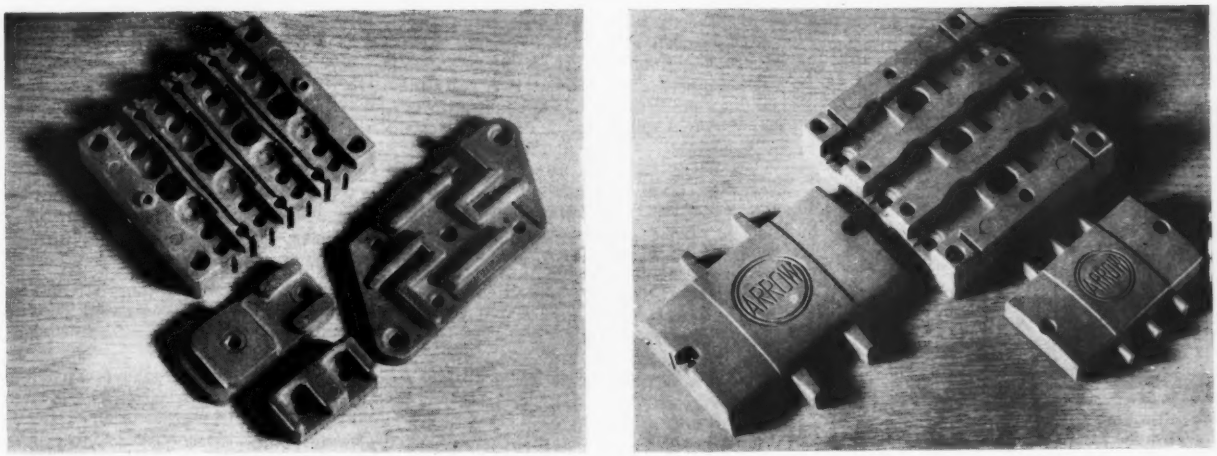
TABLE 2.—Water-absorption Characteristics
(% in 24 hr. at 23°C.)

	%
Granular (A.M.C.420)	0·08—0·10
Granular, self-extinguishing (A.M.C.422)	0·04—0·06
Putty (A.M.C.411)	0·39—0·41
Putty, self-extinguishing (A.M.C.417)	0·05—0·08
Glass-filled, self-extinguishing (A.M.C.440A)	0·07—0·10

As no material is a perfect insulator, measurement of resistivity (i.e., reciprocal conductivity) gives an indication of its ability to resist the passage of an electric current across the surface or through the mass. Surface resistivities greater than 12 $\log_{10}$ ohms and volume resistivities greater than 13 $\log_{10}$ ohms-cm. are recorded for alkyd when tested in accordance with B.S.771. Even under extreme conditions, namely, three weeks' exposure at 71° C. and 100% R.H., the resistivity characteristics are exceptionally good, as may be seen from Figs. 1 and 2. These curves refer to a normal granular and self-extinguishing granular alkyd and suggest a preference for the latter when operation of the component is required under tropical conditions of temperature and humidity. The overall performance of alkyd under these conditions is, undoubtedly, partly due to its very low water-absorption. The self-extinguishing grades are even superior to the normal products in this respect, as may be seen from Table 2 and this may account for their superior resistivities under tropical conditions.

Dielectric constant and power factor are two properties particularly important in the design of electronic equipment to operate at high frequencies where losses due to dissipation of energy must be kept to a minimum. These values for the normal granular alkyd, A.M.C.420, are given in Table 3.

The insulation resistance of the alkyd moulding compounds under tropical conditions is good, but the self-extinguishing



(Left) This photograph shows a base plate and three smaller mouldings. At bottom left is a moulding produced with a 2-minute cure. Centre is a unit also produced in a 2-minute cure. The moulding on the right was cured in 90 seconds. (Mouldings by courtesy of Mawson Taylor Ltd.) (Right) Arrow-Hart switch base and hoods moulded by Insulators Ltd.

granular and putty grades are excellent. The relative merits of the different types are shown in Fig. 3 and their superiority in this respect to melamine and phenolic powders has already been described in the literature.[4]

TABLE 3.—Dielectric Constant and Power Factor of Granular A.M.C. 420

Frequency (cycles/sec.)	Dielectric Constant	Power Factor
60	6·0—6·2	0·050—0·060
10^4	4·8—5·0	0·016—0·018
3×10^6	4.4—4.6	0·017—0·010

Applications

Naturally, the principal applications of alkyd are in the electrical industry, and American manufacturers have had considerable experience of these new moulding compounds during the past six years.

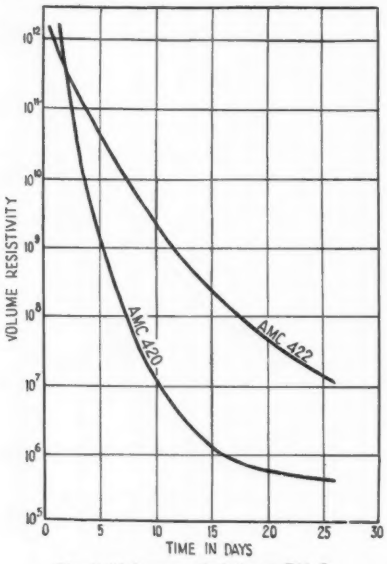


Fig. 2 Volume resistivity at 71° C and 100% R.H.

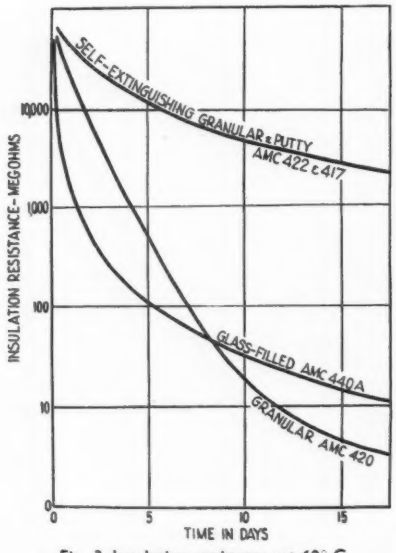


Fig. 3 Insulation resistance at 60° C and 95% R.H.

Terminal blocks moulded in granular alkyd for use in magnetic motor starters resulted in 50% reduction in production time and 25% reduction in overall cost. The high arc resistance and insulation value of the material allowed higher ratings and one starter was only half the conventional size.

Contactor switch bases and hoods are already being moulded in this country in the self-extinguishing, granular alkyd by Arrow Electric Switches, Ltd. A.M.C.422 was chosen for this application because of its outstanding arc resistance, excellent dimensional stability, high dielectric strength and insulation resistance at high humidities. Exhaustive tests were carried out to determine the suitability of alkyd for this particular application. After prolonged subjection to interrupting arcs as high as 20 times normal motor currents, at 600 volts, 0.5 power-factor loads and subsequent tests at 5,000 amps. short-circuit conditions, the base and hood showed only discoloration from silver-salt deposits, which could easily be cleaned off. No failure of the moulding material was observed.

The present demands for miniature electronic components are an obvious outlet for the alkyd moulding compounds and, since the impact strength of the glass-filled grade is higher than that of any other thermosetting material, miniaturization need not be accompanied by fragility. Valve bases, precision connectors and television tuner segments are being moulded in alkyd, in the latter case to tolerances of only half a thou., and the heat resistance of the alkyd allows soldering operations to be carried out without damage to the moulding. Advantage is also being taken of dimensional stability at high temperatures, dielectric strength and arc resistance in the moulding of ignition-coil tops. Magneto rotors, moulded in alkyd because of its insulation resistance and anti-tracking properties, are showing a 50% overall saving in cost. Similarly, rotor arms and caps for distributors have been moulded and a fractional horse-power motor has been produced with an alkyd case housing a ring magnet.

The putty forms are specially suitable for condensers and capacitors, which can be preassembled and moulded into one piece, including the leads, to give stable, moisture- and heat-resistant units.

The alkyd moulding compounds are new raw materials for British industry with applications in many fields from telecommunications to heavy electrical switchgear and from aircraft relays to arc shields. They will not be suitable for every purpose but, in view of American practice, it is reasonable to suppose that they will find an eminent and honourable position among the insulating materials available to the electrical engineer.

Acknowledgments

The authors wish to thank the directors of Resinous Chemicals, Ltd., for permission to publish this paper and to acknowledge a debt of gratitude to Barrett Division, Allied Chemical and Dye Corporation, for much unpublished data which was made available.

References

(1) *Plastics*, 1952, **XVII,** No. 181 (Aug.), 243-245. (2) *Plastics*, 1955, **XX,** No. 210 (Jan.), 24-25. (3) C. A. Redfarn, *British Plastics*, 1954, **27,** No. 4 (Apr.), 131-133. (4) M. H. Bigelow and P. E. Nowicki, J. Electrochem. Soc., 1953, **100,** No. 2 (Feb.), 60-62.

A New Miniature Universal Machine Tool

BY V. BIRD

A NEW universal miniature machine tool, now available in Great Britain, can be used for the turning, drilling, milling, grinding and polishing of metals, wood, and plastics. It has been used by plastics workers in Austria with great success and should therefore be of equal interest to their colleagues in this country. The main constructional components of this miniature machine tool are as follows: (1) A cast-iron bed (approx. 3½ in. by 12 in.) equipped with a longitudinal spindle (pitch 0.039 in. Scale at handwheel, 1 graduation = 0.002 in.). (2) A headstock with adjustable spindle sleeve (shift ¾) and a piercing bore of 2¾ in. (3) A motor for mains connections (40 watt at 4,000 r.p.m.) attached to the headstock. (4) A reduction gear for variation of the speed of the main spindle in 19 stages (from 300 to 9,000 r.p.m.). (5) A cross slide with cross-feed screw (pitch and graduation same as for longitudinal spindle). (6) A pivoted tool holder which can be rotated through 360°. (7) A vertical column with connecting piece.

The various applications of the tool are as described below:—

Used as a Lathe

Height of centres 1.42 in. Distance between centres 5.5 in. It is possible to turn between centres as well as in overhung position by using a chuck. The pivot headstock facilitates turning of tapered surfaces.

Used as Table Drill Press

When a table drill press is required the vertical column instead of the headstock is inserted into the bed and the headstock attached to the column. Height of drill lift is ¾ in.; sweep is 3 in. The drill chuck can take tools from 0 to 0.24 in. diameter. The pivot headstock makes it possible to carry out inclined as well as vertical drilling operations.

Used as a Milling Machine

When a grinding wheel (attached to the grinding wheel holder) is used instead of the chuck, horizontal and vertical surfaces, also prisms can be ground.

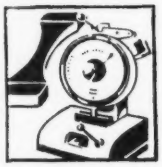
Used as a Hand Drilling Machine

The piece for the connection with the vertical column is removable and designed to serve as a handle.

The examples quoted above do not, by any means, represent a complete list of the applications of this machine tool. There are also a number of interesting accessories. The manufacturers are the Austrian firm of Maier and Co. Fabrik für Spezialmaschinen, Hallein/Austria, and their agents in Great Britain are J. and H. Smith, Ltd., 6-8 The Headrow, Leeds, 1.

World's Industry Employs Plastics

MATERIALS and TESTING



Polyamide.—A survey of the properties of polyamides, their treatment and application has been given by H. R. Jacobi, being a communication of the plastics raw materials department of Badische Anilin und Sodafabrik, A.G.
(*VDI-Zeits*, 1954/Dec. 21/1197.)

Plastics testing at high and low temperatures.—C. H. Klute and L. B. McKee describe equipment used to conduct a variety of mechanical tests on a 60,000-lb. universal testing machine in the range of −70 to −500° F., and a low-temperature impact tester, which can be used from room temperature to −70° F.
(*A.S.T.M. Bulletin*, 1954/Dec./50.)

The migration of plasticizers.—K. Zöhrer and A. Merz discuss methods to determine the migration of plasticizers in various kinds of plastics. A connection between oil solubility and migration could be confirmed. Small addition of pigments and silica gel do not affect migration.
(*Kunststoffe*, 1955/Jan./9.)

Resistance to deformation under heat.—A new German standard, DIN 53462, has been issued which specifies details of the well-known Martin's test apparatus in which the sample, placed vertically, is subjected to an equal bending moment by a clamping head with a movable weight.
(*Deutscher Normenausschuss*, Berlin, W.15.)

Absorption of cold water.—A German provisional standard, DIN 53472, has been issued specifying shape and manufacture of samples, number of samples, performance of tests, etc.
(*Deutscher Normenausschuss*, Berlin, W.15.)

Heat-sealability of regenerated cellulose films.—Several methods for measuring this property are described but appear not to be satisfactory. A new method has been in use for several years and gives reproducible results.
(*Kunststoffe*, 1955/Jan./16.)

Injection moulding of polyamides.—F. Schaupp describes the processing conditions in detail in order to give process moulders an opportunity to acquaint themselves with these methods.
(*Kunststoffe*, 1955/Jan./33.)

Fibrous Teflon.—New engineering material for solving technical problems in gaskets and belting. They are one of the most chemically resistant fibres with excellent stability at elevated temperatures.
(*Product Engineering*, 1954/Dec./190.)

Vinyl-coated glass cloth.—A new high-strength waterproof vinyl-covered glass-fibre fabric, Weblon, has high tensile strength and tear resistance through the woven glass-fibre cloth.
(*Materials and Methods*, 1955/Jan.144.)

Glass-filled silicone compound.—A high-impact-strength, glass-filled silicone moulding compound has been developed to produce electrical and electronic parts for high service temperatures. It can withstand continuous exposure at 450° F. and intermittent exposure to 650° F.
(*Materials and Methods*, 1955/Jan./141.)

Epoxies insulate motors.—In a new winding technique that utilizes Epoxylite (American Insulating Materials Co.), bare, cleaned stator iron is immersed in an insulating bath and cured. This is repeated until a coating of about 0.004 to 0.006 in. is obtained over the entire section.
(*Power*, 1954/Nov./122.)

MISCELLANEOUS USES

Heat-resistant adhesives for metal bonding.—Developed for the fabrication of guided-missile structures, the new adhesives are found useful in automotive, aircraft and electronic parts. The adhesives can stand temperatures as high as 600° F. NAA Hi Temp is especially suitable for metal-to-metal bonds, whereas CHT is a modification for sandwich constructions.
(*Materials and Methods*, 1955/Jan./107.)

Plastics patches for pipe repairs.—The American Navy has developed for emergency purposes a plastics patch, which is easily applied and puts a ruptured fire-main pipe or a cooling system back into operation in about 30 minutes.
(*Tool Engineer*, 1955/Jan./181.)

Plastics camera.—The design of the 1954 "Brownie" has followed the following basic principles: (1) Making maximum use of plastics to permit the integral moulding of many additional features at no extra cost beyond the original dies; (2) reducing all secondary operations to a minimum; and (3) designing all parts with an eye on assembly time.
(*Product Engineering*, 1954/Dec./152.)

Nylon torque tube.—A new timer reset for automatic control is equipped with a nylon torque tube inserted in the dial-set pointer cup, trimmed at one end and spun integral at the other with the pointer.
(*Product Engineering*, 1954/Dec./148.)

INDUSTRIAL APPLICATIONS

Polyethylene cable sheath.—W. T. Eppler presented a paper on the thickness measurement and control in the manufacture of polyethylene cable sheath, which was started on a large scale about six years ago by Western Electric Co.
(*Wire and Wire Products*, 1954/Oct./1177.)

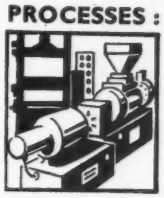
Epoxy-glass laminate.—An uncured epoxy-impregnated glass laminate gives consistent strength properties and may be formed by matched die, bag moulding or vacuum forming.
(*Materials and Methods*, 1955/Jan./139.)

Experiences in plastics tooling.—A survey is given answering the following questions: What is the present status? Which materials are being used and what direction is resin development taking?
(*Materials and Methods*, 1954/Dec./106.)

Flexible coupling.—A new flexible coupling consists of two flanges connected by flexible plastics pins of a low modulus of elasticity. No data on the plastics material are given.
(*Industrie Kurier*, 1954/Dec. 29/514.)

Plastics tin rollers.—Plastics-covered rolls are now used in producing tin plate. Advantages are resistance to acids, non-magnetic and anti-static. Further, marks on tin plate are avoided due to bits of rubber being picked up from present rolls.
(*Business Week*, 1954/Nov./94.)

PROCESSES : MACHINERY



Hot spraying of vinyl paints.—Carbide and Carbon Chemicals Co. have developed a hot circulation system to keep paint at 160° F. A coating thickness of up to 0.003 in. can be applied instead of about 0.001 in. for cold paint.
(*Chemical Week*, 1954/Oct. 23/46.)

Twin-screw extruders, which were originally developed for rigid p.v.c., are now used for most thermoplastics, and also as compounding and granulating machines.
(*Kunststoffe*, 1954/Dec./601.)

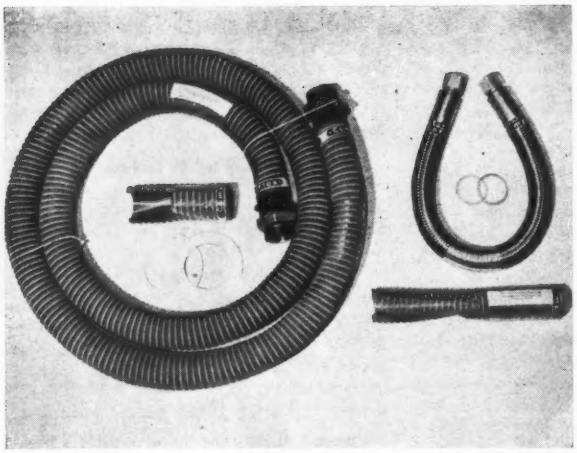
Producing large plastics mouldings.—Useful hints and recommendations for the production and planning of large TV cabinets are given.
(*Tool Engineer*, 1955/Jan./196.)

Vacuum moulding of thermoplastics is still in the process of development. Preparation and finishing are giving new problems. Mould design and construction are, however, simplified.
(*Kunststoffe*, 1954/Dec./562.)

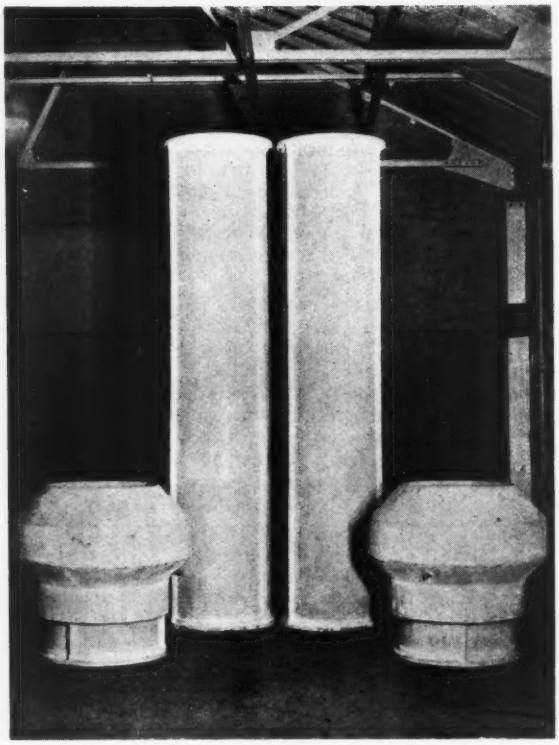
Coldforming of plastics is applied in the production of fibres and bristles by cold stretching. The operation is carried out below the actual softening temperature. A constriction occurs separating the stretched from the unstretched part.
(*Kunststoffe*, 1954/Dec./569.)

Investigating high polymers.—H. Mark describes a quick-acting osmometer which has advanced considerably the study of macromolecular solutions. A dielectric method for determining the molecular weight is also described.
(*Kunststoffe*, 1954/Dec./577.)

New Productions



(Above) H.T.P. flexible hosing, made from p.v.c. and Terylene.



(Right) Fume ducting fabricated from glass fibre and polyester resin. Cellobond resin was used, manufactured by British Resin Products Ltd.

H.T.P. Flexible Hose

A news item in the February issue of *Plastics* (page 61), described a demonstration of high-test hydrogen peroxide-carrying hose at an exhibition organized by Compoflex Co., Ltd. The photograph above shows examples of the range of H.T.P. flexible hose and ancillary equipment developed for the Ministry of Supply. On the left can be seen p.v.c./Terylene wire-supported hose for suction or delivery. The hose has an internal diameter of 1½ in.

Vacuum-formed Wall Plaques

The photograph below is, strictly speaking, outside the scope of this "New Productions" feature, since it shows a wall plaque vacuum formed in acetate sheet as an experiment. The mould used is a piece of wrought iron work, rescued from a junk yard, and the sheet was formed on one of the new vacuum-forming machines manufactured by the Latymer Engineering Company. This machine was described in "Plastics News," February.

The chief artist of Temple Press Ltd. has spent some time in painting the reverse side in the traditional Nativity colours, and the resultant effect is remarkably good. Due to the surface gloss of the acetate, the plaque appears to have been enamelled.

Glass-reinforced Plastics Fume Stacks

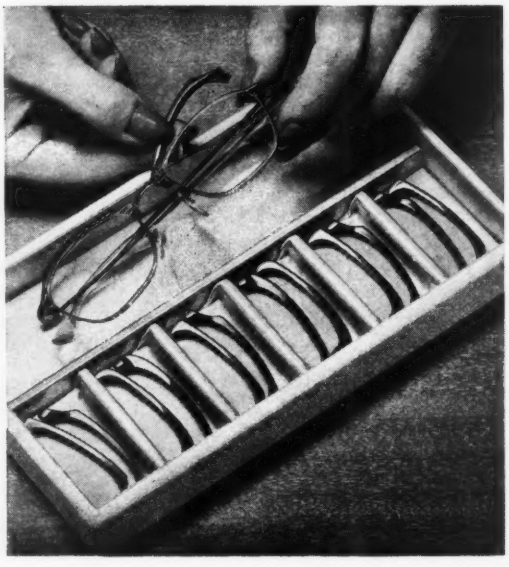
Because of their high strength/weight ratio and resistance to corrosion, glass-reinforced plastics are being increasingly applied in many branches of industry. The photograph above shows two Robertson-type ventilators to be used in conjunction with the two fume stacks shown alongside. The stacks, which are about 15 ft. long, and the ventilators, were made by James Mitchell and Son (Greenock), Ltd.

Interchangeable Spectacle Trims

When a lady must wear glasses, why not make them an attractive accessory as well as an aid to vision? The American Optical Company has carried out this idea in new frames with interchangeable top trims, in two different styles and ten fashion/selected colours of Tenite (cellulose acetate butyrate) plastic. The trims can be easily put on or taken off and can be changed in a moment to harmonize with the change of costume. The clear temple tips, also in Tenite, are inconspicuous and blend with natural complexion. Tenite is marketed in the U.S. by Eastman Chemical Products, Incorporated, Kingsport, Tennessee, and in Great Britain by Kodak, Ltd., Kingsway, London, W.C.2.

(Right) Spectacle frames in cellulose acetate butyrate.

(Below) Vacuum-formed wall plaque in acetate.



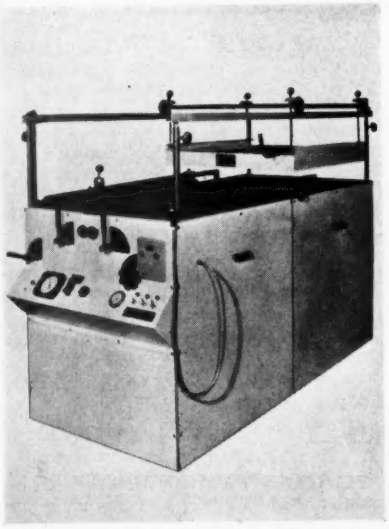
Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

YADRAN VACUUM FORMING MACHINE.—Yadran, Ltd., 137 Blenheim Crescent, London, W.1, have been carrying out experimental work since last year with vacuum forming machines. After considerable experience had been gained with prototypes and also with service machines in use in industry, a machine has now been standardized, being marketed at £395. Considerable numbers have been purchased by companies abroad.

The Plastovac, as the machine is called, is not fully automatic but has been designed to obviate the possibility of human error as far as possible. Every part of the machine has been perfected to provide final adjustment so that it may be used for extremely deep drawing up to 18 in. and so that any forming area may be used up to a maximum of 30½ in. by 34⅜ in.

Incorporating all the normal features to be found in units of this kind, a refinement is a slow-draw device which has the advant-



Yadran single platen vacuum forming machine.

age of permitting deep, intricate draws to be made with materials of a high stress nature that might break in the normal strain of the ½ second evacuation time of which the machine is capable. The Plastovac measures 78 in. by 36 in. and the control panel, as can be seen from the photograph, is set at a convenient angle.

The air receiving tank formula is 3.47 cu. ft., overall weight of the machine approximately 1,344 lb. and the pump consumption (heating unit) 6½ kW.

The manufacturers recommend material thicknesses to range from 0.005 in. to $\frac{3}{16}$ in. The heating cycle, depending upon the material used, is approximately 8-14 seconds per 0.010 in. of thickness. Moulded units are ejected by compressed air and the material cooled by a compressed air gun.

Drape forming is possible with the aid of a special frame which clamps the sheet of plastic material. A large mould, as is often the case in drape forming, is then laid onto a platform in place of the forming box and the heater raised to a height of approximately 6 in. above the mould.

HOECHST CHEMICALS, LTD., formerly Lawfer Chemical Co., Ltd., announce that Farbwerke Hoechst A.-G., Frankfurt (M)-Hoechst, Western Germany, have acquired 50% of the ordinary share capital, which has been increased to £50,000. Dr. K. Weil (director of Farbwerke Hoechst A.-G.) and the Rt. Hon. F. J. Bellenger, P.C., M.P., have joined the board of directors. Hoechst Chemicals, Ltd., will continue to handle in this country the products of Farbwerke Hoechst A.-G. A new company has been formed under the name of Lawfer and Company, Limited, to carry on the activities of the former business relating to non-Hoechst products.

INDICATOR.—Leaflet No. 294B, issued by the Cambridge Instrument Co., Ltd., 13 Grosvenor Place, London, S.W.1, describes the latest and redesigned Cambridge direct-reading pH indicator. One new feature is the provision of a second scale in millivolts (range minus 400 to plus 1,000 mV.) which can be read with ease down to five millivolts.

INDEX TO "PLASTICS"

The index to "Plastics," Volume 19, January to December, 1954, is now in print, and is available upon receipt of 4d. to cover postage and packing. Application should be made to Temple Press Ltd., Bowling Green Lane, London, E.C.1.

O. AND M. KLEEMANN, LTD.—At the annual general meeting of the company held in London on January 31, a resolution, providing for the increasing of the capital of the company to £440,000 by the creation of 2,400,000 additional ordinary shares at 1s. each was made.

"ALKAPAKS."—A new booklet produced by the Paper Goods Manufacturing Co., Ltd., Westmead Road, Sutton, Surrey, illustrates the wide range of uses for "Alkapaks" as envelopes and bags, as drum, case and sack liners. "Alkapaks" are made from Visqueen polythene film.

MELWOOD THERMOPLASTICS, LTD.—The company now has new offices at Brewery House, High Street, Harpenden, and all correspondence should be sent to this address. The works remain at Willoughby Road, Harpenden, to which address all goods should be consigned.

BAKELITE, LTD.—Mr. H. Perrett, one of the company's designers, won a high commendation and an award of £10 in the 1954 Horners Competition for his design of a public telephone booth. Mr. Perrett was a pupil at the St. Martins School of Art and joined the sales office of Warerite, Ltd., at the end of 1945. His work embraces all the aspects of design in which the company is interested, including display work for exhibitions and preparation work for Warerite pictorials.

APPOINTMENTS TO CATALIN BOARD.—The directors of Catalin, Ltd., announce that Mr. A. J Perryman and Dr. F. L. Gilbert have joined their Board as from January 31. Mr. Perryman has served the company for 17 years on the research and manufacturing side and is in charge of the products division. Dr. Gilbert, who has been with the company for six years, is in charge of the development and commercial activities of the industrial resin division.

WARERITE, LTD.—The company's stand at the Ideal Homes Exhibition will be in three main sections, illustrating the use of Warerite laminated plastics in the home.

ATOMIC MODELS.—Griffin and Tatlock, Kemble Street, Kingsway, London, W.C.2, have issued a very handsome leaflet, some of the photographs being in full colour, describing the Courtauld Atomic Models. These are designed for use in research and education and are made on a scale (0.8 in. equals 1 Angstrom) large enough to permit of accurate quantitative work. They are believed to be the first models designed to incorporate an elastically distortable bond of great use in the investigation of steric hindrances.

NEW B.I.P. APPOINTMENT.—Leslie M. Sanders, formerly southern area sales manager (moulding powders) British Industrial Plastics, Ltd., has now been appointed group liaison officer for the B.I.P. Group. Mr. Sanders' new duties include co-ordination of various Group activities and, in particular, the reception and liaison of all overseas visitors who desire to visit the B.I.P. factories. His 20 years' experience in the plastics industry, coupled with a fluent knowledge of languages, render him especially suitable for this task. We regret that in our announcement giving the speakers at the Swedish Plastics Convention last November, we omitted Mr. Frank Schollick, chemist-in-charge of the coating resins department at B.I.P. Chemicals, Ltd.

NEW BEX CATALOGUE.—A very comprehensive catalogue of the products of Halex Ltd., has just been published, devoted to household utensils. An introduction schedules the various plastics used, and briefly describes their properties and suitable methods of cleaning them.

"GLUES FOR TIMBER LAMINATING" is the title of a new booklet available free from Leicester, Lovell and Co., Ltd., North Baddesley, Southampton. The following adhesives, their properties, suitable applications, etc., are described: casein, urea, resorcinol and phenolic. An appendix gives details of high frequency gluing, and a bibliography is included.

G.E.C. TRAINING SCHEME. — A method of training boys leaving public and grammar schools to become professional engineers has been introduced by the General Electric Co., Ltd. It is an industry-based "sandwich scheme" operated by the company in conjunction with the Birmingham College of Technology. In future all boys in this category who are selected by the company for training will on leaving school at the age of 18, be given a five-year course in which full time sessions of six months at the College of Technology, will alternate with six-month periods of industrial training in the company's works. At the end of the course a young man will have gained exemption from the professional requirements of a body such as the Institution of Electrical Engineers, and will, if he remains with the G.E.C., have as good prospects in the company as the man who has spent three years at the University, followed by two years as a graduate apprentice. A fully illustrated booklet describing this scheme is available from the Educational and Personnel Services, the General Electric Co., Ltd., Magnet House, London, W.C.2.

THE BRITISH STANDARDS INSTITUTION has issued a revised edition of B.S. 1203 "Synthetic resin adhesives for plywood (phenolic and aminoplastic)." In the new edition three types of synthetic resin adhesive have been specified and their classification has been made on the basis of their durability under exposure to weather, upon which data have been obtained over a number of years for the phenolic and aminoplastic resins in current use. The results of these long-term trials have been linked with the behaviour of standard test-pieces when immersed for prescribed periods in cold, hot or boiling water, or steam, and tests of this nature are the distinguishing requirements of the revised standard. B.S. 1204, originally published under the same cover as B.S. 1203, is at present under revision and will be published separately. A reprint of B.S. 1204:1945 is now available, price 3s. 6d. Copies of B.S. 1203 can be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. Price 3s.

ST. ERIK'S FAIR will be held at Stockholm from August 27 to September 11. Details can be obtained from Thirza West Publicity Ltd., 141 New Bond Street, London, W.1.

SILICONES FOR INDUSTRY. — An exhibition on the history, production and application of silicones is to be held at the Chamber of Commerce, Birmingham, from February 28 to March 5. Invitations are obtainable from Midland Silicones Ltd., 19 Upper Brook Street, London, W.1.

AMERICAN TRADE FAIR.—A World Plastics Fair and Trade Exposition is to be held in Los Angeles, from April 6 to 10. Information on this Exposition may be obtained from the Fair organizers, at 8762 Holloway Drive, Los Angeles 46, California.

THE RADIO COMPONENT SHOW will be held at Grosvenor House, London, W.1, from April 19 to 21. Amongst the exhibitors will be Bakelite, Ltd., showing copper-faced laminated sheet for the production of printed circuits and glass laminates based on melamine, silicone and phenolic resins for improved electrical characteristics. Moulding materials will also be shown including the alkyd compounds and also rubber-modified phenolic compounds and Vybak extrusion compounds.

INFRA-RED PANELS USED IN PRODUCTION OF FLOOR COVERINGS.—At the Wellite Works, of Welwyn Plastics, Ltd., new infra-red heating panels, designed and supplied by the General Electric Co., Ltd., are being used in the production of floor, furniture and car upholstery coverings made from p.v.c.-coated fabric. The paste, which is sprayed by a doctor knife, passes beneath three of the new panels at a speed of between 2 to 16 ft. a minute, depending upon the thickness and type of coating. The panels are 7 ft. long and 2 ft. wide and each contains 41 sheathed wire elements arranged with their length at an angle to the direction of flow with material to ensure freedom from streaking. Behind the elements is a reflecting surface of aluminium, backed by glass-fibre insulation to reduce convection heat losses.

AUTOMATIC FEED FOR BENCH POWER PRESSES.—A new automatic feed designed for use with the "Worcester" range of bench power presses is being introduced by Jones and Attwood, Ltd. The feed is of the single side-roll type and pulls the stock through the tool. The feed increment is variable with a maximum of 1¼ in. and the rollers will take a stock width of up to 4 in.

A.I.D. APPROVAL GRANTED TO CREATORS, LTD.—A.I.D. approval has now been granted, following inspection by the Aeronautical Inspection Directorate, of the new factory at Plansel Works, Sheerwater, Woking, Surrey, of Creators, Ltd.

MONSANTO CHEMICALS, LTD., announce the appointment of Mr. N. F. Patterson, director and general manager of production, as operations director responsible for all manufacturing operations of the company.

MR. S. MOTTRAM recently appointed technical service manager of British Geon, Ltd., is making a two-month tour, of Australia and New Zealand to give technical service and assistance to the p.v.c. consuming industry in these two countries. Mr. Mottram will be returning via the U.S.

MR. A. T. CHAPMAN-PURCHAS.—Formerly sales manager of Scott Bader and Co., Ltd., Mr. Chapman-Purchas has now joined William R. Warner and Co., Ltd., as export manager.

CHANGE OF ADDRESS. — Plastics Injectors, Ltd., announce that their new address is Queensway, Enfield, Middlesex. All communications should be sent to this address.

ABERDARE CABLES LTD., announce that Mr. H. de C. Falle, having completed over 50 years in the electrical industry is relinquishing his executive position of general sales manager. He will remain on the boards of Aberdare Cables (Holdings) Ltd., Aberdare Cables Ltd., and South Wales Switchgear Ltd.

MR. F. G. PENTECOST, who last year celebrated his 50th-year of service with A. Boake Roberts and Co. (Holding), Ltd., has retired from the office of managing director. He will continue as chairman of the company; Mr. Bertram White, B.Sc., has been appointed his successor.

BIMCAM LUNCHEON.—The 11th annual luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association was held at Londonderry House, Park Lane, London, W.1, on January 18. Amongst the speakers were Sir Roger Duncalfe, President of the British Standards Institution and Sir Edward Boyle, M.P., Parliamentary Secretary to the Ministry of Supply.

AMERICAN PRODUCTION OF POLYTHENE.—Production under licence from I.C.I., Ltd., of polythene obtained by the cracking of propane has commenced at the Texas Eastman Company. The new plant has an estimated annual capacity of 20,000,000 lb. One of the features of this polythene is that for both moulding and extrusion the granules are spherical in shape and of a more or less standard size.

SEBACIC ACID.—The Geigy Co. Ltd. have introduced a more flexible price basis for sebacic acid. Lots of from 1 to 10 tons are now available at 5s. 7d. per lb. For lots of over 50 tons the price is 5s. 5d. per lb.

ALLWEATHER PAINTS, LTD., specialists in the manufacture of chlorinated rubber paints announce two new products. The first, Pital cold temperature resistant paint will withstand temperatures of as low as −60° F., and yet remain flexible. The second, a chlorinated rubber-based paint has incorporated in it a fungicide, which will not affect the durability of the paint film, and provides a barrier against mould growth.

SILICONE PLANT OWNERSHIP TRANSFER.—Albright and Wilson, Ltd., announce that the ownership of their silicone plant at Barry has been transferred to Midland Silicones, Ltd. Albright and Wilson are majority shareholders in Midland Silicones, the balance of the shares being held by Dow Corning Corporation of America.

MANCHESTER SHOWROOM.—To give a better opportunity for scientists and industrialists from the north to inspect new and improved instruments, laboratory equipment and chemicals, Baird and Tatlock (London), Ltd., have opened new offices and showrooms at 58 Lever Street, Manchester. Coinciding with the opening of the new office is the announcement of the appointment of Mr. A. E. Hobson as the northern manager of the B.T.L. organization.

INCREASED RANGE OF PROTECTIVE CLOTHING.—Fabric-supported p.v.c. gloves and clothing are amongst the latest developments in the range of protective clothing manufactured by James North and Sons, Ltd., Godley Mills, Hyde, Cheshire. A full range of p.v.c. clothing is also available in non-toxic white material designed specifically to meet the requirements of the food, milk, confectionery and allied trades.

IRRADIATED POLYTHENE EXTRUSIONS.—Anchor Plastics Co., Inc., 36, 36th Street, Long Island City 6, New York, have initiated a new service designed to make available cross-linked tubes, extruded shapes and rods in polythene. Companies can obtain these units for their own testing and development programmes, made to specification in each case with various irradiation dosages. Thus, for example, 1,000 ft. of a .172 in. o. d. oval tube, with a wall of .020 in. is extruded in polythene and supplied in small coils in batches with irradiation dosages ranging from 10 x 10^6 REP (REP means Roentgen Equivalent Physical) to 32 x 10^6 REP. This quantity, which would be sufficient for an extensive test, would cost only a few hundred dollars. As an example, two pieces of the .050-in.-thick extruded die cut and irradiated polythene were put into an oven together with two identical non-irradiated pieces. After 60 minutes at 250-275° F. and 20 minutes at 300° F. the non-irradiated samples had melted to such an extent that they started dropping off their supports. The irradiated samples were not affected.

UNION CARBIDE TO HELP BUILD ITALIAN SYNTHETIC RUBBER PLANT.—In a joint statement issued last month by Morse G. Dial, president of Union Carbide and Cabon Corporation, and Enrico Matei, president of Italy's Ente Nazionale Idrocarburi (E.N.I.) and its subsidiary, Azienda Nazionale Idrogenazione Combustibili (A.N.I.C.), it was announced that Union Carbide has contracted to act as consultant to A.N.I.C., and in an advisory capacity to help to design and build a $75,000,000 plant to manufacture synthetic rubber from natural gas in the Po Valley at Ravenna, Italy. Union Carbide will furnish consulting and management assistance in planning, design, construction and "start-up" operation.

Ente Nazionale Idrocarburi supplies nearly 90% of the natural gas produced in Italy. Through a 2,000-mile network of pipelines it feeds methane for fuel purposes to many industrial plants in northern Italy.

PURE CHEMICALS, LTD., announce that they have made arrangements with the Ferro Chemical Corporation of U.S.A. to act exclusively as their manufacturing and distributing agents in Europe. At the same time Pure Chemicals, Ltd., announce that by agreement with Shell Chemicals, Ltd., they are now able to offer Epikote resins in the p.v.c. stabilizer field under their Stanclere trade-name. The combination of these resources with the existing Stanclere series will enable Pure Chemicals to offer a complete range of p.v.c. stabilizers of all types, both straight chemical and compounded. The installation of a complete demonstration plant and customer service laboratory at Kirkby will facilitate satisfactory formulation for each user's needs.

FEDERATION DINNER AND DANCE.—The British Plastics Federation celebrated its 21st birthday with a dinner and dance for over 800 at the Grosvenor House, London, on February 18. Mr. Arthur Skan, the chairman, cut the cake. The evening, which included a cabaret, was a remarkable tribute to the growth of the industry.

MONSANTO CHEMICALS, LTD.—Dr. W. A. Hayward, works manager at the Ruabon factory, to be assistant to the managing director, Mr. Philip A. Singleton. His appointment is a preliminary to assuming, with the American associates, Monsanto Chemical Company, world-wide responsibilities as technical liaison officer for Monsanto Chemicals, Ltd., and Monsanto Chemicals (Australia), Ltd. Mr. E. V. Weekes, formerly area manager at the Ruabon factory, is appointed works manager in succession to Dr. W. A. Hayward.

OIL AND COLOUR CHEMISTS ASSOCIATION.—Amongst the exhibitors at the 7th technical exhibition which opens on Tuesday, 15 of this month, are the following companies: Aero Research, Ltd.; Albright and Wilson, Ltd.; Bakelite, Ltd.; British Industrial Plastics, Ltd.; British Industrial Solvents; British Oxygen Co., Ltd.; British Resin Products, Ltd.; R. H. Cole and Co., Ltd.; Dunlop Special Products, Ltd.; Hercules Powder Co., Ltd.; Imperial Chemical Industries, Ltd. (three divisions); Midland Silicones, Ltd.; Monsanto Chemicals, Ltd.; Petrochemicals, Ltd.; Scott Bader and Co., Ltd.; Shell Chemicals, Ltd.; Styrene Co-Polymers, Ltd.; Vinyl Products, Ltd.

AERO RESEARCH TECHNICAL NOTES.—Obtainable from the company at Duxford, Cambridge, Bulletin No. 144 comprises a report on static and fatigue tests carried out on Redux-bonded built-up and solid light-alloy spar booms. The work was carried out at the National Aircraft Laboratory, Amsterdam, in conjunction with the Fokker Company. Very full information is given, including diagrams of assembly, graphs, photo-micrographs, and tables.

TELCON STAFF DINNER.—The Staff Association of The Telegraph Construction and Maintenance Co., Ltd., and Submarine Cables, Ltd., held their seventh annual dinner and dance at the Dorchester Hotel on February 11. Nearly 450 members and their guests heard Mr. J. N. Dean, chairman of both companies, reply to Mr. I. C. Coombs (deputy chief accountant), who proposed the toast to the company.

THE GAUGE AND TOOL MAKERS' ASSOCIATION.—On February 3 the Association held a luncheon at the Savoy Hotel, London, the guest of honour being the Right Hon. Selwyn Lloyd, Minister of Supply. During the course of the luncheon the president handed a cheque for £3,000 to the president of the Board of Governors of the Hospital for Sick Children, to endow a cot in the name of Sir Winston Churchill, as a birthday present celebrating his 80th birthday.

"Plastics in the Service of Man"

The following is a list of full names and addresses of companies mentioned in the illustrated feature, "Plastics in the Service of Man," which appears on pages 76 and 77 in this issue:—

55. The Fighting Services—2

Bakelite-Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1.
Beetle Products-British Industrial Plastics, Ltd., 1 Argyll Street, London, W.1.
Bristol Aeroplane Co., Ltd., Filton, Bristol.
H. Comoy and Co., Ltd., 90-92 Pentonville Road, London, N.1.
De Havilland Aircraft Co., Ltd., Hatfield, Herts.
Fairey Aviation Co., Ltd., Hayes, Middlesex.
Fibreglass, Ltd., Ravenhead, St. Helens, Lancs.
Hawker Aircraft, Ltd., Canbury Park Road, Kingston, Surrey.
J. F. Kenure, Ltd., Faggs Road, Feltham, Middlesex.
Metropolitan Plastics, Ltd., 17-20 Glenville Grove, Deptford, London, S.E.8.
Pamphonic Reproducers, Ltd., Westmoreland Road, London, N.W.9.
Perspex-I.C.I., Ltd., Plastics Division, Welwyn Garden City, Herts.
R. B. Pullin and Co., Ltd., Great West Road, Brentford, Middlesex.
Rotax, Ltd., Willesden Junction, London, N.W.10.
Runcolite, Ltd., 3 Vere Street, London, W.1.
Shawcraft Models, Bathurst Walk, Iver, Bucks.
J. Starkie Gardner and Co., Ltd., Merton Road, London, S.W.18.
W. H. Tant and Co., Ltd., Birmingham.
W. and J. Tod, Ltd., Ferrybridge, Weymouth.
Turner Manufacturing Co., Ltd., Villiers Street, Wolverhampton.

MEETINGS

March

16th.—"Mechanism of the Thermal Breakdown of Linear Polyesters and Related Polymers," Prof. P. D. Ritchie, B.Sc., Ph.D., F.R.I.C., F.R.S.E. Plastics Institute, North-Eastern Section, Oak Room of Mining Institute, Newcastle upon Tyne. Joint meeting with the Royal Institute of Chemistry. 7.0 p.m.

18th.—"Shock Curing of Laminates," L. Welch. Plastics Institute, Midlands Section, James Watt Institute, Great Charles Street, Birmingham. 6.30 p.m.

21st.—"Vacuum Forming," D. Latham, B.Sc., on "Machinery"; D. R. Crabtree on "Materials and Products." Plastics Institute, London Section, Waldorf Hotel, Aldwych, London, W.C.2. 6.30 p.m.

25th.—Spring Dance, Plastics Institute, Midlands Section.

25th.—Open Problems Evening. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester, 2. 6.30 p.m.

30th.—"Aspects of Colour Fastness and Finish for Clothing and Plastic Accessories." I. Glasman, A.T.I. Plastics Institute, Western Section, New Technical College, Stratford Road, Stroud, Gloucester. Joint meeting with West of England branch of the Textile Institute. 7.15 p.m.

April

4th.—"Improved Impact Polystyrene," S. D. Eagleton, F.R.I.C. Plastics Institute, Midland Section, Bell Hotel, Leicester. 6.45 p.m.

13th.—"The Extrusion and Injection Moulding of Akulon," Dr. J. F. Kohlwey. Plastics Institute, South Wales and Monmouthshire Section, Newport Technical College. 7.0 p.m.

16th.—"Terylene," Miss Z. Paddon, informal ladies' evening. Plastics Institute, Yorkshire Section, The Metropole Hotel, King Street, Leeds, 1. 7.30 p.m.

TALKING SHOP . . .

Railway Boom. The announcement by the British Transport Commission of its plan to modernize British Railways in the next 15 years sparked off considerable comment in Britain's national newspapers and technical journals. Although we have heard much during the past 20 years of forthcoming railway reorganization, culminating in nationalization, which was to solve all of our problems, this plan is the first to deal with the fundamental issues involved and, if implemented, will result in a complete reorganizing of the whole of our railway system. The adoption of this plan, which calls for an expenditure over a 15-year period of £1,200m., will mean big contracts for numerous British industries, particularly the oil engine, electrical and civil engineering industries. The two first mentioned will be particularly involved by virtue of the decision to electrify a great proportion of our railway system and to make wide use of Diesel locomotives, resulting in the complete banishing of the steam engine.

The plastics industry can also look for considerable work as a result of the plan. By far the most obvious use of plastics in railways is in the finishing and decoration of rolling stock for passenger work. For some long time Warerite and Formica laminated plastics have been gaining increasing use, a rational development which goes hand in hand with the modern all-steel railway coach. Synthetic upholstery, particularly of the woven p.v.c. type, already a great success in buses, may be expected to find wide use in railway trains, particularly on suburban lines. These applications are obvious.

Less obvious but equally important are the electrical components which will be required for the expanded electrified systems. These take many forms and can be expected to provide a welcome influx of business to the compression moulding side of our industry. Similar components will be called for in reorganized signalling systems.

Other important uses of plastics materials include laminated resin-bonded asbestos bearing materials used extensively in rolling stock and locomotives to damp oscillatory movement.

That this reorganization of our railway system is necessary is beyond doubt. It is also certain that for many branches of our industry it will provide considerable revenue over the next 15 years.

* * *

Staff Parties. Mr. A. Reingand, managing director of Thermo-Plastics, Ltd., got his company's annual social and dance off to a good start by forecasting a 20% increase in production for 1955, following a 14% increase in 1954 compared with the previous year. The party, held in January, was organized on behalf of both the Dunstable and Welwyn Garden City branches of the company and was preceded by a children's party in the afternoon, which was held at the White Hart Hotel.

Apart from an extensive business in the advertising field, Thermo-Plastics manufacture a wide range of products for the armed forces, one of their most notable being the canopy for the Hawker Hunter.

* * *

Price War. According to a report in a recent issue of the *Express and Star*, an American recording firm is installing pressing plants and equipment in a Wolverhampton plastics factory. It is intended to send the records direct from the factory to shops, eliminating distributors, resulting in a total price cut of over 50%. Whatever the result, an increase in the already high level of sales of records may be expected and, in consequence, an increasing use of vinyl materials in the long-playing type.

* * *

Laminated Minesweeper. According to a *Daily Telegraph* report for February 3, a major fire at the Defoe Shipbuilding Co., Bay City, Michigan, has resulted in the abandonment of a £½m. research programme for the U.S. Navy. Destroyed in the fire was the prototype of a 51-ft. experimental minesweeper, constructed from glass fibre/polyester reinforced materials and designed to serve as a non-magnetic vessel.

It is to be hoped that this project, despite the fire, will go ahead, since the increasing use of glass fibre structures by Admiralty departments is probably the best way of ensuring that craft of this kind will also be used by the sailing enthusiasts. The experience that boat-builders gain by working to service contracts should eventually be passed on to the enthusiast in the form of cheaper and more durable craft.

* * *

The Old, Old Story. Our very efficient press-cutting service uncovered a most amusing titbit for me the other day. Headed "Mistakes Make Fortunes," the article (published in a very famous and popular weekly) set out to show how mistakes were responsible for several noteworthy discoveries. The old chestnut about the first plastic was told in all seriousness—how the laboratory cat knocked a jar of formaldehyde into its milk, turning the milk into a resinous substance. Naturally, a chemist in the laboratory noticed this and by a process of rationalization discovered the secret of casein.

All this reminds me of the millions the chemical companies spend every year on research into new materials, and on improving existing ones. Why bother—leave it to the office cat.

* * *

New Use for P.V.C. in Agriculture. Trials now being carried out at the Berkshire Institute of Agriculture seem to indicate that the most effective cover for silage is p.v.c. sheet, held in place by chalk or earth. This follows experiments with other materials such as corrugated iron and thatch. The cost is reported to be favourable, about 2s. 0d. per ton of silage covered.

Tropical Tests for Acetate Films. The British Industries and Allied Industries Research Association has published an important report entitled "Behaviour of Cellulose Acetate Films under Tropical Conditions." Written by Dr. N. J. L. Megson, Head of the Chemistry Department at R.A.E., Farnborough, and Dr. V. E. Yarsley, the well-known consultant, the report is, as might be expected, extremely well prepared.

Cellulose acetate films, of varying acetyl contents and containing a range of known plasticizers, were made up under standard conditions. The films were exposed to artificial and natural tropical conditions. The effect of such conditions was assessed by observations of mould growth formation, together with changes in visual appearance, electrical properties, mechanical properties and chemical composition.

Comparative tests showed the significant difference between films made on a laboratory scale and those made industrially.

The results indicated that changes in films were much greater after 12 weeks' natural exposure in West Africa than after 28 days in a "tropic" chamber, and no correlation between the two types of exposure was possible.

Copies of the report, price 27s. 0d., are available from the Association, at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

* * *

Epoxy Resins for Plastic Patterns. The versatile epoxy resins are now being produced for making plastic patterns, and, it appears, offer marked advantages over other resins that have been tested for this purpose. Aero Research, Ltd., who are responsible for the development of "Araldite" Casting Resin M for pattern making, state that shrinkage on setting is very low indeed and quite negligible when fillers are used. It is also claimed that the hardened resin is tough, durable and dimensionally stable. "Araldite" Casting Resin M sets cold in 24 hours, or in a shorter time if gentle heat is applied.

As shrinkage and brittleness have hitherto been regarded as inherent defects of plastic patterns, the introduction of the epoxies into this field will arouse considerable interest in foundries, and should contribute significantly towards reducing high costs. Full details of "Araldite" Casting Resin M are obtainable from the makers, Aero Research, Ltd., Duxford, Cambridge.

* * *

Ekco Advertising Campaign. During the next three months the Plastics Division of E. K. Cole, Ltd., are running the biggest-ever national advertising campaign for the wide range of Ekco "Gold Seal" domestic ware. Full-page and half-page advertisements are being featured in national magazines and papers which have a combined circulation of over 18 million copies. These insertions are in addition to the double-spread advertisements which are appearing in the ironmongery and hardware trade press.

PLASTIKON.

The Properties and Testing of Plastics Materials—Part I.

Properties of Materials, Moulding Test Specimens, Conditioning, Quality Control, Dynamic Properties.

By A. E. LEVER,* A.I.R.I. and J. RHYS,† M.Sc.

This article is the first of a series intended to bring together the published literature on the testing of plastics materials, emphasizing the practical rather than the theoretical aspects. With the rapidly growing use of plastics in consumer industries, testing becomes of ever greater importance; it is intended, with the aid of tabular information and cross references, to offer both to the plastics industry, and to the industry's customers, a guide to test methods and a comparative evaluation of the properties of plastics. This latter aspect will serve as a valuable source of reference to all who deal with the applications of these materials.

Section 1. Properties of Materials

IN testing any material there are some obvious properties which have to be investigated and, in addition, specific properties which are important in view of the "end use" of the final product. Plastic specifications are exclusive in that each relates to one chemical family and to that alone.

A material cannot be evaluated without also considering the method of preparation of that material. This is important for comparative tests.[1]

A list of tests applied to electrical mouldings is given[2]:—

Physical. Specific gravity, hardness, porosity (water absorption).

Mechanical. Tensile strength, compressive strength, impact strength, machinability.

Electrical. Electric strength, flashover, volume and surface resistivity, power factor, permittivity.

Thermal. Plastic yield, thermal conductivity, thermal expansion, heat resistance.

Chemical. Resistance to reagents and oil, ageing.

Optical. Transparency, haze, refractive index.

There is also a useful discussion on the testing of plastics for use in aircraft,[3] and the tests principally employed are:—

Static Strength. Tension, compression, shear, flexure, bearing.

Dynamic Strength. Fatigue, repeated flexing.

Stability. Water absorption, warping at 71° C. (tension, compression and flexing).

Durability. Toughness and some of the above properties after ageing. (Accelerated and/or natural.)

There is an excellent summary of the mechanical properties of plastics under various environmental conditions,[3] with a good bibliography.

While B.S.903/1950 deals with the testing of vulcanized rubber, it should also be consulted by those engaged in the testing of plastics, as in many cases there is a useful discussion relating to the various properties.

The mechanical strength testing of plastics is discussed,[4] and an interpretation of such tests is given[5] in a general discussion on resin-bonded fibre products, with special reference to aircraft design.

Although testing methods are often different in various countries, the basic principles are, in many cases, the same. These principles are stressed, with additional data, and references where appropriate.[6]

An excellent theoretical treatment of the mechanical properties of high polymers is given.[7] The effect of conditions of time, temperature, etc., on some physical properties are noted and discussed.

The properties of all plastics are affected by changes in temperature, and with thermoplastics the effect is large enough to constitute a serious problem in testing.[8] There is a good discussion, although somewhat theoretical, given in[9].

The physical testing of plastics is discussed with descriptions of various apparatus used in British and American specifications.[10]

The properties of phenolic materials which are of interest to the engineering industry are discussed.[11]

For those interested in the theory of the rheology of metals, polymers and liquids, there is an excellent report.[12]

The testing of plastics is dealt with in a general way.[13] Some plastics, in addition to those possessing crystalline orientation, are found to react differently to external conditions, depending on the direction in which the test is applied. This is termed "Anistropy." Materials whose properties do not vary with the direction of test are termed "Isotropic." Where the former is the case, the material must be tested in two directions, e.g., calendered sheet in the direction of calendering (longitudinal) and at right angles to the direction of calendering (transverse).

When a non-uniform cure is encountered, e.g., in thick sections of thermosetting plastics, it is usual for the surfaces to be more highly polymerized than the interior. The skin is stressed in tension and the interior is compressed. Loss of plasticizer during curing may give a similar effect.

Mica and chopped cloth tend towards lamellar structure during moulding, and properties such as impact strength exhibit a greater deviation from the average than in resins containing fillers with small particles, e.g., wood flour.

There is a good collection of engineering data on plastics[14] dealing specifically with information needed by the product engineer, and a useful bibliography on properties and testing of plastics from 1940-1949.[15]

Details are given[16] of the requirements for the British Standards Institution Certification Mark for plastics.

The durability of plastics under Post Office conditions is discussed.[44]

Section 2. Moulding Test Specimens

There are several specifications dealing with the moulds and methods of moulding test specimens. 1. The design of standard moulds to be used for moulding test specimens from plastic moulding materials. Disc, tension specimens and injection-moulded test pieces are covered.[17] 2. Moulding test pieces of phenolic materials.[18] 3. Moulding test specimens of amino plastics.[19]

There is another specification covering the general principles involved in injection moulding of test pieces.[20]

For measuring the "moulding index" of thermosetting plastics,[21] it is noted that the method can be used to determine batch-to-batch uniformity of a given plastic, but not for certainty in determining whether different types of materials have the same "moulding index." A cup mould of flash type is used.

Whilst not strictly the subject of the testing of plastics, there is a useful paper on heat distortion and thermal efficiency of the plastic moulding press.[22] The data presented does not enable detailed conclusions to be drawn, but is of an informative and useful character.

The effect of moulding conditions and temperature on polystyrene is discussed.[43] Brief data is given.

Section 3. Conditioning

Conditioning is the process of subjecting a material to a stipulated influence, or combination of influences, for a stipulated period of time.[23]

Such influences may be relative humidity, temperature, light, pressure, and air composition.

Conditioning is necessary both for certain manufacturing operations and for testing, and the principles regarding conditioning and weathering of plastics are discussed.[4]

The conditioning of plastics and electrical insulating materials for testing is covered.[24]

Data is presented[25] on tests made to determine the stability of moulded parts. For service conditions one should determine the moisture content and preheating technique

* Consultant. † Senior Lecturer in Plastics, National College of Rubber Technology.

before moulding, so as to obtain the optimum physical properties. Methods of test are given.

Standard laboratory temperatures and humidity for testing are given,[24] R.H. 50%, temperature 23° C. The room temperature of unspecified R.H. shall be 20° to 30° C.

The conditioning of amino-plastics prior to testing is specified in [26].

Section 4. Quality Control

A series of articles on quality control in plastic mouldings[27] deals with the principles and methods and the organization necessary for creating an effective inspection procedure.

When testing plastics, or when considering acceptance clauses in specifications for plastics, it is largely, and often almost entirely, the inherent variability of the test itself which introduces the element of uncertainty into the results.[28] The statistical principles in the preparation of specifications are discussed.

British Standards Specification[29] should be consulted.

Economical control of the quality of materials and manufacturing products is discussed.[29, 30] Methods of collecting, arranging, analysing, inspection and test records are given.

A new publication on the "Design and Analysis of Industrial Experiments"[31] deals comprehensively with the application of modern statistical methods to the design and analysis of experiments in chemical and allied fields of research.

Methods of calculating standard deviation, mean, etc., are given.[29]

Some information on statistical control and sampling are contained in a Plastics Institute Monograph.[32]

It is not enough to take samples from batches at uncertain intervals. A well-planned sampling system is essential.

Section 5. Dynamic Properties

The trend toward higher speeds in engineering makes it imperative to have some knowledge of the dynamic behaviour of materials under vibration. Knowledge of static properties is insufficient.[3]

Static Forces (stresses) remain essentially constant, or change slowly without exhibiting any repetitive characteristics.

Dynamic Forces (stresses) include all those not considered static and may be divided into three groups: (a) Alternating forces, which fluctuate between two limits, usually in a sinusoidal manner. Vibrations generally include alternating forces. (b) Reversed forces, which are alternating forces with the two limits equal in magnitude but opposite in sign. (c) Impact forces, which are generally produced when the kinetic energy of colliding bodies is absorbed by deflection in the material. They usually possess a high rate of change relative to time.

Dynamic or vibrational testing[4] may be either of the free type (torsion pendulum, extension or compression) or forced type (resonance vibrators, non-resonance vibrators and wave propagation).

The Dynamic Factor is a property restricted to dynamic testing and is a measure of the inelastic properties of a plastic, and an indication of the amount of applied work that is converted into heat, i.e., the energy stored in the sample. It is also a measure of toughness.

Toughness is important in structural engineering, but the term has not been clearly defined. It is bound up with impact strength, but this is only a guide, and it is much more a function of strength, elasticity and internal damping. In certain cases it may be defined by the ratio of the square of the tensile strength to the modulus of elasticity.

Toughness may be determined by using a damage impact test method in which a steel ball is dropped from successively greater heights on to the centre of the specimen clamped between wooden frames. The test cannot be correlated with the Izod or Charpy impact tests.

Dynamic loads for a long period of time cause fatigue.[33] A dynamic loading causes a resonance wave to be set up within the material and this superimposes itself over the normal applied stress.

Measurements of the dynamic characteristics of elastomers are ordinarily accomplished by the use of one of the following systems: (a) Forced resonance. (b) Free vibratory decay. (c) Flexometers or non-forced vibration.

Flexometers provide the most direct method and one is described[34] which attempts to overcome some disadvantages of other types of flexometers, particularly their inability to measure low hysteresis. It resembles the Marvin apparatus.[35]

Nielsen Torsion Pendulum[36]

The specimen is fixed at the bottom and attached at the other end to a known mass, supported by a fine wire. The mass is displaced from its rest position, and with the specimen acting as a spring, is released and allowed to oscillate in free vibratory motion. The amplitude of the vibrations decreases at a rate dependent on the damping factor of the plastic. The frequency of the oscillations is a measure of the modulus. Small quantities, e.g., 1 gramme, can be used.

Layan Oscillator[37]

This apparatus supplies sufficient forced load or strain oscillations to break the specimen. It will not measure the characteristics of material above the temperature of rubberlike behaviour.

Yerzley Oscillograph[38]

This is used for determining mechanical properties of vulcanized rubbers (synthetic and natural) under compressive or shear strains.

Roelig Machine[39, 40]

A comprehensive investigation of the usefulness of this machine has been made[41] with rubber test pieces under compression. It is shown that neither the deformation nor the force set up in the rubber varies sinusoidally, as is normally assumed in interpreting the results. This anomalous behaviour seriously limits the usefulness of the machine for evaluating dynamic characteristics of rubber.

Another apparatus is described[42] for measuring the dynamic mechanical properties of rubberlike materials at small amplitudes for frequencies of 5-200 cps. over a large temperature range. It gives the dynamic Young's Modulus in compression ($E = E' + jE''$) and the complex shear modulus.

A conference on the dynamic testing of rubber[39] deals with both theoretical aspects and their practical influences. References to methods which employ sinusoidal oscillations produced electro-mechanically will be found in this report and in [45].

An investigation into the dynamic mechanical properties of polyvinyl chloride is reported.[46] The oscillations are produced by an Elac vibrator. It is assumed that the deformations vary sinusoidally, and it is reported that the results for dynamic properties of p.v.c. with 15% and 25% di-octyl phthalate as plasticizer lie on the same curves as the results for electrical properties.

As with the Roelig machine, the results from machines using electrically produced vibrations are difficult to interpret, for, once again, neither the deformations nor the forces set up in the high polymer can be represented mathematically by so simple an equation as that of the sine curve.

References

(1) A.S.T.M. Spec. D. 695-52T. (2) *Br. Plast.* 1952, **25,** 188. (3) Symposium on Plastics—A.S.T.M., 1944. (4) Symposium on Plastic Testing—A.S.T.M., 1952. (5) Symposium on Mech. Properties of Plastics—Soc. Chem. Ind., 7.3.1952. (6) B.S.756. (7) Mechanical Behaviour of High Polymers—Interscience Pub. Inc., N.Y., 1948. (8) Elastomers and Plastomers—Elsevier Pub. Co. Inc., N.Y., 1948. (9) *Br. Plast.*, 1952, **25,** 367. (10) Testing and Analysis of Plastics—Plastics Institute Memo. 20 and 20A, 1948. (11) Handbook of Engineering Plastics—Geo. Newnes, 1943. (12) Essays in Rheology—Pitman, London, 1947. (13) Fundamentals of Plastics—McGraw-Hill, N.Y., 1946. (14) Plastics Handbook for Product Engineers—McGraw-Hill, N.Y., 1946. (15) Mod. Plast. Encly., 1950, 992 and 1001. (16) B.S. 1253, 1945. (17) A.S.T.M. Spec. D. 647-51T. (18) A.S.T.M. Spec. D. 796-51. (19) A.S.T.M. Spec. D. 956-51. (20) A.S.T.M. Spec. D. 1130-50T. (21) A.S.T.M. Spec. D. 731-50. (22) *Trans. P.I.*, 1946, 106. (23) A.S.T.M. Spec. E41-48T. (24) A.S.T.M. Spec. D. 618-44T. (25) *Plastics* (Lond.), 1952, **17,** 72. (26) B.S. 1322, 1946. (27) *Plastics* (Lond.), Dec., 1947, to Mar., 1949. (28) *Trans. P.I.*, Apr., 1947, 52. (29) B.S. 600R, 1942. (30) B.S. 1008, 1942. (31) Design and Analysis of Industrial Experiments—Oliver and Boyd. 1954. (32) Testing and Analysis of Plastics—Plastics Institute Mono. C.2. (33) Phenolic Resins—Iliffe and Sons, London, 1950. (34) A.S.T.M. Bull., 1951, No. 177, 45. (35) *J. Appl. Phys.*, 1950, **21,** 197. (36) *Rev. Sci. Instr.*, 1951, **22,** 690. (37) *Mod. Plast.*, 1944, **21**, 119. (38) A.S.T.M. Spec. D.945-48T. (39) *Trans. I.R.I.*, 1950, **26,** 4. (40) *Rub. Chem. and Tech.*, 1949, **22,** 1009. (41) R.A.B.R.M. Res. Rept. No. 74. (42) *J. Appl. Phy.*, 1944, **15,** 309. (43) *Trans. P.I.*, 1954, **22,** No. 49, 219. (44) Plastics Progress—Iliffe and Sons, 1953. (45) *J. Appl. Phy.*, 1948, **19,** 753. (46) *J. Appl. Chem.*, 1954, **4,** 507.

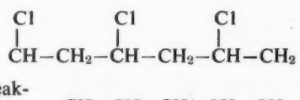
Metal Soaps as Vinyl Stabilizers

By W. G. VENNELS, A.M.C.T., A.I.R.I., A.P.I.*

THE degradation of polyvinyl chloride after prolonged exposure to ultra-violet light or high temperatures, such as might be encountered during processing or in service, is normally shown by discoloration, brittleness and general loss in physical characteristics.

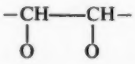
The changes brought about by heat degradation, however, are different from the degradation effects induced by light for, in the latter case, decomposition is evinced by brittleness followed at a later stage by discoloration, whereas with heat degradation the polymer usually discolours long before any physical deterioration is observed.

Despite these differences, the mechanism of the physical breakdown and of the colour reaction is essentially the same and is considered to originate with a hydrogen chloride unit splitting out from the vinyl polymer followed by oxidation at the resulting points of unsaturation. The hydrogen chloride evolved exerts a further catalytic action by promoting step-wise removal of more hydrogen chloride down the chain, resulting in a conjugated double-bond system of the following type (1):—



It is, of course, known that such conjugated double bonds are highly chromophoric and with progressive polymer decomposition, which is appreciably influenced by time and temperature, more are produced, resulting in marked colour changes within the resin.

At high temperatures or under the influence of ultra-violet light, oxidation of the molecule may also occur, with subsequent formation of peroxides which are relatively unstable:—



Oxidation and cross-linking at the highly reactive double bonds leads to embrittlement and the production of colour-forming carbonyl groupings. An investigation of the infra-red absorption characteristics of heat-degraded polyvinyl chloride has confirmed the presence of these groupings (2):—

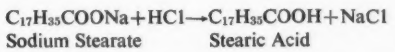
They also tend to cause higher light absorption and thus produce more radicals capable of attacking the polymer chain.

In order, therefore, to protect the resin against such degradation and to minimize the formation of polyene systems, it is customary to add to the vinyl composition a stabilizer, the primary function of which is to inhibit the evolution of hydrogen chloride either by absorption or neutralization, thus delaying further decomposition by removal of the catalyst.

Metal Soaps as Stabilizers

Growing in importance as vinyl stabilizers in the plastics industry are the metal soaps, for, apart from fulfilling the conditions necessary for stabilization by neutralization of the hydrogen chloride, they assist in processing by lowering the working temperatures and, at the same time, provide internal lubrication. This is of great importance during calendering, moulding and extrusion, as it reduces the heat generated during processing, thereby minimizing the tendency to decomposition and consequently the amount of stabilizer needed.

In addition, the low heat build-up imparted by many stearates helps to reduce the amount normally required for stabilization. The mechanism of their stabilizing action is generally attributed to their reaction with the free hydrogen chloride. forming a metal chloride and a weak organic acid.



The metal portion of the soap is considered to play the major part in the stabilization mechanism, but where water resistance, clarity and odour are important features then the fatty-acid radical is of consequence and may well influence the choice of stabilizer for a given application.

While most stabilizers neutralize the hydrogen chloride or act as acid acceptors and thus minimize the formation of polyene systems, these are not always eliminated. Quite often, even without colour development, a molecular re-arrangement within the polymer may occur, particularly at high processing temperatures, which can considerably influence the service life of the plastic material. The degradation products thus formed catalyse further breakdown and thereby increase the formation of polyene systems.

Despite continued research the varied processing conditions and the wide end uses to which vinyl plastics are put make stabilization a difficult problem and so far there is on the market no single stabilizer which satisfies the conditions so necessary for complete stability against heat and light. In order to achieve better all-round stabilization, double and triple combinations are becoming increasingly popular and there seems little doubt that, if suitably applied, these combinations can prove of immense value in resisting the breakdown of vinyl polymers by heat, light and oxygen by providing an effect greater than the sum of the individual stabilizers. Generally, the efficiency of stabilizers depends to a large extent upon the type of resin, the plasticizer,[3] filler content, processing conditions and application of the finished product.

Sometimes overlooked in the compounding of vinyl plastics is the re-working of previously processed scrap, e.g., that from calendered sheet, moulded and extruded goods. In practice this is normally reworked with new material, and to ensure proper stabilization additional stabilizer over and above that normally present is recommended.

Essential Requirements

Essentially the requirements of a stabilizer may be summarized as follows: 1. The stabilizer should be permanent and show no deleterious effects upon physical properties. 2. The stabilizer should be immune from the leaching effects of water and its resistance to extraction by oils and fats should be relatively high. 3. Where the finished product is likely to come into contact with foodstuffs, the absence of odour, taste and toxicity require prime consideration. 4. The stabilizer should neither "bloom" or "sweat."

Other requirements are compatability, transparency, dispersibility, colour, volatility, electrical characteristics and flame resistance, as well as the usual heat and light stability, all of which are properties often requiring careful individual consideration. The stabilizer should also have no effect on the heat-sealing characteristics or the capacity of the final product to take printing.

Consequently, the selection of stabilizers to meet specific conditions must be made with the greatest of care and hence the need for separate tests, particularly with reference to heat stability, light stability and lubrication.

The following notes on the properties of individual soaps provide a guide to their use as vinyl stabilizers.

Barium Octoate. Although barium octoate imparts a slight yellowing to the vinyl compound, it is nevertheless a good heat stabilizer for translucent and opaque stocks, and where light stability is of importance it is often used in conjunction with a cadmium-type light stabilizer.

It has no adverse effects on the heat-sealing and printing properties of vinyl compounds and is recommended where the stabilizer should have a negligible odour. Normally from 1-3 parts per 100 resin are recommended.

Barium Stearate. Besides its normal application as a heat stabilizer/lubricant, particularly in calendering work, barium stearate is often recommended where sulphur staining is to be avoided. On account of its high melting point, which allows the use of comparatively high operating temperatures during processing, it has proved particularly useful in high-speed

* Ferodo Ltd.

calendering processes. From 2-4 parts per 100 polymer by weight are recommended.

Barium Ricinoleate. Offered as a stabilizer, barium ricinoleate ranges from a fine powder to a granular relatively dust-free form, the latter often being preferred. It is also available as a solution which gives improved clarity over the solid form and with comparable stability. It is used alone only when initial yellowing of the compound during processing is not of importance.

When used in conjunction with other stabilizers, notably cadmium octoate and a tri-aryl phosphite or epoxy resin, excellent heat and light stability is achieved. It is also recommended for use with plastisol and organosol preparations; 1.5-3 parts per 100 resin are normally recommended.

Calcium Ricinoleate. Considered a non-toxic stabilizer and gives good thermal and reasonable light stability. Heat stability may be further improved by incorporating zinc octoate in the compound, thus giving a non-toxic combination. It is suitable for use in clear stocks. Used alone, from 2-5 parts per 100 polymer by weight are recommended.

Calcium Stearate. This metal soap has long been recommended as a lubricant and heat stabilizer for non-toxic vinyl compounds. If, however, the product is required to possess good heat-sealing and printing characteristics, the quantity employed must be carefully controlled. It is generally used in translucent stocks. For lubrication purposes 0.5-1.5 parts per 100 resin are normally recommended, while for heat stability 1-4 parts are generally sufficient. Improved heat stability may be obtained by incorporating a small quantity of zinc octoate, and the combination has the advantage of being non-toxic.

Cadmium Laurate. An excellent heat and light stabilizer and finds wide popularity in extruded and calendered goods. It is also employed in clear plastisol and organosol compounds and for spread coatings.

It is often used with barium laurate to give improved results. Used alone, 1-3 parts per 100 polymer by weight are recommended. In combination with barium laurate, 1.5 parts of the latter with 1.0 parts of cadmium laurate give excellent heat and light stability.

Cadmium Naphthenate. More of a light, rather than a heat, stabilizer, and where good thermal stability is required is usually used in combination with a known heat stabilizer. It imparts a slight darkening to the vinyl compound. From 1-2 parts per 100 polymer are usually recommended.

Cadmium Octoate. Where the minimum effect on the seat-sealing and printing characteristics of vinyl films is desired, then cadmium octoate is to be recommended.

It is used in translucent stocks and often in combination with barium soaps to give improved heat and light stability. Used alone, from 1-3 parts per 100 resin are recommended.

Cadmium Stearate. Where clarity combined with outstanding heat and light stability are required, then cadmium stearate is to be recommended, particularly for high-quality transparent and coloured goods. Like most other metal soaps, it shows good lubricating and release properties.

The degree of stability imparted by the use of cadmium compounds as stabilizers is, to a certain concentration, almost proportional to the amount of cadmium present in the resin. When used in excessive amounts, however, they tend to cause darkening of the polymer on heat exposure and consequently the amount employed must be carefully controlled.

They are not recommended for use under conditions where ingestion may occur.

Cadmium Ricinoleate. Used in clear stocks and acts as a heat and light stabilizer. It is seldom used alone but often in combination with epoxy or barium octoate stabilizers. Exceptionally clear stocks may be obtained by using equal parts of cadmium ricinoleate and epoxy resin in a total concentration of 3 parts per 100 polymer.

This stabilizer possesses the ability to reduce the formation of colour-forming bodies when the resin is subjected to heat exposure. It is also a good light stabilizer for paste-forming resins but does not render them heat stable.

Lead Octoate. A particularly useful heat stabilizer in so far as it has no adverse effect on the heat-sealing and printing properties of vinyl films. Like most lead salts, it is, however, toxic and gives rise to sulphur staining; 1-3 parts per 100 resin are recommended.

Lead Phthalate. Shows good heat and light-stabilizing propensities and is particularly useful in opaque and electrical compositions. Like the octoate, it is toxic and gives rise to sulphur staining. The quantities employed are the same as for the octoate.

Lead Stearate. As a stabilizer for opaque and semi-transparent vinyl compositions, lead stearate finds wide popularity and possesses the lubricating properties common to most metal soaps. It gives good results in electrical compounds and is particularly useful in calendered, extruded and moulded goods. It contains a lower metal content than the dibasic stearate and in consequence weight for weight is inferior to the latter in heat-stabilizing activity. The lubricating properties, however, are superior. It may either be used alone or in combination with other stabilizers to give improved results.

From 1-3 parts per 100 polymer are recommended.

Dibasic Lead Stearate. Shows less tendency to "sweat" and better clarity than the standard grade. It is, in addition, a superior heat stabilizer and contributes to ease of extrusion, mould flow and easy release from hot roll and mould surfaces; 1-3 parts per 100 polymer are usually recommended.

Lead Undecylenate. Is not widely employed as a stabilizer but is regarded as suitable for use where clarity is important. It is, however, said to have proved superior to lead stearate with regard to heat stability, initial colour and clarity; 1-3 parts per 100 resin are normally recommended.

Lithium Stearate. Is a good all-round stabilizer for p.v.c. and offers clarity combined with good thermal and light-resisting properties. Because of its excellent lubricating properties and high melting point, it enables manufacturers of vinyl sheeting to operate at higher temperatures with resulting increase in output.

Like other soaps from this particular group of the periodic table, it has a high water solubility and is not recommended where water resistance is of importance. It is regarded as a non-toxic stabilizer; 2-4 parts per 100 resin are usually recommended.

Strontium Laurate. Is more of a light, rather than a heat, stabilizer. As with most strontium soaps, it is often used in conjunction with cadmium or lead soaps to give improved results. Used alone, strontium soaps are considered non-toxic; 1-3 parts per 100 polymer are normally recommended.

Strontium Naphthenate. Of the strontium stabilizers, the naphthenate finds, perhaps, the most popularity. Like the laurate, it is more of a light stabilizer and gives limited thermal stability. In order to give improved heat stability, it is often used in conjunction with a known heat stabilizer. It imparts a slight amber coloration to the processed stock. Proportions used are normally the same as for the laurate.

Strontium Stearate. Being compatible with numerous solvents and plasticizers, this particular stabilizer finds acceptance where

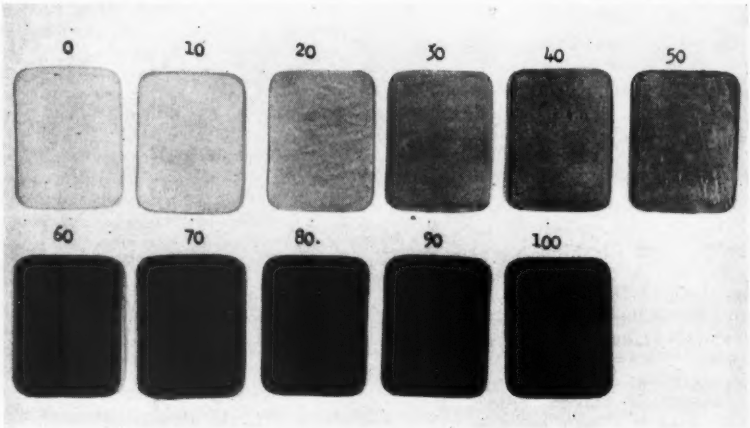


Fig. 1. Rating table for tests shown on facing page.

TABLE OF TEST RESULTS

Stabilizer combinations (parts by weight)			Heat stability rating at 170°C. (mins.)							
			15	30	45	60	75	90	105	120
Basic lead carbonate/cadmium laurate ..	3.0	—	10	10	10	20	30	40	40	50
	2.0	1.0	10	10	10	20	20	30	40	40
	1.5 +	1.5	10	10	10	20	20	30	40	40
	1.0	2.0	10	10	10	20	20	20	30	30
	0.5	2.5	10	10	10	10	20	20	20	20
	—	3.0	10	10	10	20	20	20*	90	100
Stabilizer TK.2 (mixed proprietary stabilizer)	3.0		10	10	10	20	20	20	30	30
Basic lead carbonate/cadmium stearate ..	3.0	—	10	10	10	20	30	40	40	50
	2.0	1.0	10	20	30	30	30	40	40	50
	1.5 +	1.5	10	20	20	20	30	40	40	50
	1.0	2.0	10	20	20	20	30	40	40	40
	0.5	2.5	10	10	10	20	20	20	30	30
	—	3.0	10	20	20	20	20*	100		
Stabilizer TK.3 (mixed proprietary stabilizer)	3.0		0	0	10	10	20	30	30	30
Lead stearate/lead silicate	—	3.0	10	40	60	70	70	80	80	90
	1.0	2.0	10	20	30	60	70	80	90	90
	1.5 +	1.5	10	10	20	60	70	80	90	90
	2.0	1.0	10	10	20	40	70	80	90	90
	2.5	0.5	10	10	10	20	20	30	30	40
	3.0	—	10	10	10	20	30	70	80	90
Stabilizer TK.4 (mixed proprietary stabilizer)	3.0		0	10	20	20	30	40	40	50
Barium ricinoleate/cadmium laurate ..	—	3.0	10	10	10	20	20	20*	90	100
	1.0	2.0	10	20	20	30	30	40	90	100
	1.5	1.5	10	20	20	20	30	30*	90	100
	2.0 +	1.0	10	20	20	30	30	30*	40*	100
	2.5	0.5	10	20	20	30	40	40*	40*	50*
	2.75	0.25	10	10	20	30	40	40	50*	50*
	3.0	—	20	30	40	50	60	70	80	90
Strontium stearate/lead stearate	—	3.0	10	10	10	20	30	70	80	90
	0.5	2.5	10	10	20	30	30	40	50	90
	1.0 +	2.0	10	10	20	20	30	40	50	70
	1.5	1.5	10	10	10	10	20	30	50	60
	2.0	1.0	10	10	10	10	20	50	60	70
	3.0	—	20	30	30	40	60	60	70	80
Sodium stearate/strontium stearate ..	—	3.0	20	30	30	40	60	60	70	80
	1.0	2.0	10	20	30	30	40	50	60	70
	1.5 +	1.5	10	20	30	30	40	50	60	70
	2.0	1.0	10	20	30	30	30	40	50	60
	3.0	—	10	20	20	30	40	50	60	70
Barium ricinoleate/zinc palmitate	—	3.0	10	100						
	1.0	2.0	10	10	100					
	1.5	1.5	10	10	10	20*	100			
	2.0	1.0	10	20	20	20*	20	20	100	
	2.5 +	0.5	10	20	30	40	40	40	40	40*
	2.75	0.25	10	20	30	40	40	40	50	60*
	2.875	0.125	10	20	30	40	40	40	50	60
	2.937	0.062	10	20	30	40	40	50	50	70
	3.0	—	20	30	40	50	60	70	80	90
Calcium stearate/sodium stearate	3.0	—	10	20	30	30	50	60	70	80
	0.25	2.75	10	20	20	30	50	60	70	70
	0.5	2.5	10	20	20	30	50	60	70	70
	1.0	2.0	10	20	20	30	40	60	70	70
	1.5 +	1.5	10	20	20	30	40	60	70	70
	2.0	1.0	10	20	20	30	40	60	70	70
	2.5	0.5	10	20	20	30	40	60	60	70
	2.75	0.25	10	20	30	30	40	60	60	70
	—	3.0	10	20	20	30	40	50	60	70
Barium ricinoleate/calcium ricinoleate ..	3.0	—	20	30	40	50	60	70	80	90
	1.0	2.0	20	30	40	40	50	60	70	80
	1.5 +	1.5	20	20	30	40	50	60	60	70
	2.0	1.0	20	30	40	50	50	60	70	80
	—	3.0	20	30	40	40	50	70	70	80
Sodium stearate/lead stearate	3.0	—	10	20	20	30	40	50	60	70
	2.0	1.0	10	10	10	20	20	20	30	80
	1.5 +	1.5	10	10	10	20	20	30	30	80
	1.0	2.0	10	10	10	20	20	30	40	90
	—	3.0	10	10	10	20	30	70	80	90
Cadmium laurate/barium laurate	3.0	—	10	10	10	20	20	20*	90	100
	2.0	1.0	10	10	10	20	30	80	90	100
	1.5 +	1.5	10	10	10	20	20	20	20	70*
	1.0	2.0	10	10	20	20	30	30	30	80
	0.5	2.5	10	20	20	20	30	40	40	90
	—	3.0	20	30	40	50	60	70	80	100
Barium ricinoleate/cadmium ricinoleate ..	—	3.0	10	10	20	20	30*	90	100	100
	1.0	2.0	10	10	20	20	20*	80	90	100
	1.5 +	1.5	10	20	20	30	30	30	30*	100
	2.0	1.0	10	20	20	30	30	30	50*	80*
	2.5	0.5	10	10	20	20	20	30	30*	40*
	3.0	—	20	30	40	50	60	70	80	90

* Indicates that while the colour is essentially that of the rating quoted visible signs of breakdown have occurred as evidenced by localized black spots.

TK.2, 3 and 4 are synergetic stabilizer combinations developed by Typke and King, Ltd.—an associate company of Durham Chemicals, Ltd.

TK.2 imparts clarity with outstanding thermal stability and is especially recommended where calender and mould release properties are important.

TK.3 is a synergetic mixture intended for high temperature applications. It is in addition a good light stabilizer and imparts excellent clarity.

TK.4 is a non-toxic combination imparting clarity with excellent thermal stability.

colour retention, freedom from odour and ease of incorporation are of importance. The stability imparted is almost proportional to the amount present in the resin and 2-4 parts produce clear stocks with good thermal and light stability.

It is used in film and sheeting and in plastisol and organosol preparations.

Strontium Octoate. Although showing reasonable thermal stability, it is not recommended as a heat stabilizer unless used in combination with other stabilizers where the synergetic effect gives improved results. It is, nevertheless, an efficient light stabilizer for translucent or opaque stocks; 1-3 parts per 100 resin or 0.5 part in conjunction with 2.5 parts of cadmium or lead stearates are normally recommended.

Zinc Octoate. Is one of the newer-type stabilizers and, in combination with a proper amount of an alkaline earth metal or epoxy compound, is claimed to give a powerful stabilizer system.[4] Zinc/calcium combinations are also non-toxic.

Zinc stabilizers such as the octoate, laurate or ricinoleate are said to offer the following advantages: 1. A lower cost stabilizer system is obtained. 2. Only very small quantities of zinc are required. 3. A non-sulphur staining system can be obtained. 4. Excellent non-toxic systems are possible.

They must not, however, be used by themselves.

Chelating Compounds. These are finding increasing popularity, particularly in the United States. Usually they are complex chemical compounds serving as light stabilizers, but at the same time they improve the heat stability, particularly when used in combination with organo-tin and lead compounds. As their name implies, they serve as chelating or complexing agents for metal chlorides similar to sequestering agents in the dyestuffs industry. That they do complex certain metal chlorides is readily seen by adding 1-2% of a chelating agent to a vinyl composition containing 1% lead stearate when the "fog" or "haze" due to the lead chloride is "complexed" and improved clarity results. They also act as anti-oxidants in repressing the formation of colour-bearing systems which result from heat degradation.

The composition of such materials is not disclosed and they are usually sold under proprietary trade names. One of their outstanding uses is to give good initial colour during processing as well as in moulded, extruded and calendered goods and plastisol and organosol preparations.

Synergism

This term describes a co-operative action between two or more stabilizers and is one of the most interesting studies in vinyl stabilization. By such an action better all-round stability results and often the percentage total stabilizer content can be reduced, thus lowering the cost.

Perhaps the earliest indication of such activity was that shown by the alkaline earth metal salts and cadmium salts, while the synergetic activity of co-precipitated barium and cadmium laurates and barium/cadmium ricinoleates is probably known to all interested in the compounding of polyvinyl chloride.

Similar effects are obtained with many other soap combinations and using a base mix of:—

	Parts by weight.
Polyvinyl chloride (Corvic HO)	100
Dibutyl phthallate	60
Stabilizer	3

and the rating table shown in Fig. 1.

A number of metal soap combinations have been investigated as heat stabilizers and the previous page gives the results in order of decreasing effectiveness under the particular conditions of test quoted.

In the tests shown in the table the samples are cut from the compounded processed stock by means of a die and then placed on a glass slide on a suitable tray in an air-circulated oven set at 170° C. Samples are taken from the oven at 15-minute intervals over a period of two hours and numerically rated according to the colour chart shown on a previous page.

The colour scale adopted ranges in numerical value from 0 to 100. Zero represents the reading of a glass microscope slide, while 100 represents a colour close to absolute black.

For improved thermal and light stability, particularly that demanded by the more modern and exacting processing techniques, there is little doubt that double or triple stabilizer combinations, either prepared by the compounder or purchased as proprietary materials, will in future find increasing popularity and help to solve many of the problems normally associated with single stabilizer systems.

The author wishes to express his appreciation to the directors of Typke and King, Ltd.—a division of Durham Chemicals, Ltd., Birtley, Co. Durham—for permission to publish this paper, and to several members of the technical staff for their valued assistance.

References

1. V. Warren Fox, J. C. Hendricks and H. J. Ratti. *"Degradation and Stabilization of P.V.C."* Industrial and Engineering Chemistry 41 (Aug., 1949), No. 8, p. 1774.
2. Ibid, p. 1775.
3. W. G. Vennells. *"The Influence of Plasticizers on Vinyl Stabilization."* Trans. Plastics Institute, 21 (Jan., 1953), No. 43.
4. Ferro Chemical Corporation, Bedford, Ohio, U.S.A. *"Zinc as a Stabilizer Component."* Tech. Bulletin, No. 35.

Book Reviews

The Technology of Solvents and Plasticizers, by A. T. Doolittle.

Published for John Wiley and Son by Chapman and Hall, Ltd., 37 Essex Street, London, W.C.2, price 148s.

Over a thousand pages of facts, figures and formulation of 161 different solvents and 131 different plasticizers. There in one sentence is a description of this volume, but a description which is as elementary as the book is advanced.

An endeavour has been made, and with notable success, to include the practical and theoretical aspects of the subject relating them to technology and utilization from the point of view of the principal fields in which they are employed. For the research worker in this field this book will provide a well of information which should be invaluable.

Where at one time the formulation of resinous compositions was more art than science, the trend today is for the "tailor-made" product and as this trend becomes more common, so the need for a specific knowledge of the raw materials and their properties will become a necessity. With this in mind, the importance of a work such as this should not be minimized. It is not a general survey of plastics compounds, but a specific analysis of an integral component in them and as such has much to recommend it to the chemist responsible for the formation of materials with definite properties and end usage.

Catalysts, Special Compounds and Chemical Resistant Materials. General Editor, E. Molloy.

Published by George Newnes Ltd., Tower House, Southampton Street, London, W.C.2, price 21s.

Two additions to the Chemical and Chemical Engineering Series have been published recently by George Newnes. The first of these reviewed here can be broadly divided into the three sections as indicated by the title. The catalysts section includes metallic catalysts and activated carbon. In the special compounds section ion exchange materials, non-ionic compounds and amionic agents, fluorine chemicals, the benzates and the glycols are dealt with. The chemical-resistant materials include corrosion-resistant metals and alloys, ceramics, cements, plastics and glass.

In editing this book Mr. Molloy has collected papers from some of the leading specialists in these fields and in doing so has been able to present an authoritative picture for the student, chemist, and plastics engineer.

Chemical Engineering Processes and Equipment. General Editor, E. Molloy.

Published by George Newnes Ltd., Tower House, Southampton Street, London, W.C.2, price 21s.

The second addition to the Chemical and Chemical Engineering Series gives a description of some of the machinery available and in use for the processing of materials. It would obviously take a volume of vast proportions to do justice to all the machinery designed for all the different processes, and what has in fact been accomplished in 230 pages is an attempt to give the student or engineer the working principles only. This is a wise policy and gives the reader a general picture which is easier to absorb than a more detailed individual analysis of which there are already a number published.

The processes which have been examined include mixing, emulsification, filtration, evaporating techniques, crystallization, distillation and film drying to name only a few. In addition to some excellent photographic illustrations there are several line drawings showing the working principles of machinery and of processing plant.

Monomeric Acrylic Esters, by Edward H. Riddle.

Published for Reinhold Publishing Corporation by Chapman and Hall, Ltd., 37 Essex Street, London, W.C.2, price 40s.

The acrylate and methacrylate esters in providing a series of monomers whose polymers have a divergence of properties can also have practically unlimited possibilities for modifying copolymers. Only a few of these, however, are a commercial proposition and the author has dealt only with those esters which are manufactured on a commercial scale.

The main body of the book is devoted to the polymerization, copolymerization and reactions of the acrylic esters and it would be difficult to find a book which covers so much of these subjects. Bulk, suspension, emulsion and solution polymerization and their various ramifications and reactions are investigated and the results of research are given. In copolymerization, the virtually unlimited field for investigation has been reduced by describing the reaction between the more common materials and the acrylic esters, but, even so, the number described is very large. This wide coverage has necessitated the limiting of the descriptions, but for the reader who desires a more detailed report, each chapter is provided with a full list of references. Unfortunately, the majority of these are U.S. patents. If, however, it is the results which are required, then you have them here.

Hydraulic Operation and Control of Machines, by Ian McNeil.

Published by Thames and Hudson Ltd., 244 High Holborn, London, W.C.1, price 35s.

Hydraulic transmission of power or machinery control is an important part of every moulding shop today and several excellent textbooks have been published on the theoretical side of hydraulic engineering, but rather less has been said on the practical issues involved. Mr. McNeil has, with this in mind, concentrated on the machinery, applications, and systems and their various merits and limitations.

Included are descriptions of different types of valves, intensifier units, accumulators, pumps, seals and packings; in fact, all the different equipment necessary where hydraulic circuits are being used. To illustrate his text the author has used line drawings of a simplified engineering type and has also included several photographs of typically hydraulically operated machinery. The last chapters of the book are devoted to illustrating the application of hydraulic power in different industries and give a fair picture of the importance which is attached to this branch of engineering. Taken all round, this book is informative without being pedantic, and interesting without being sensational; a formula which is the keystone to good technological literature.

Some presses! Some layout!

New BTH installation of BIPEL auto-control presses. When the time comes to expand your plant or re-equip, that's the time to think about cleaning up the moulding shop and layout, improving working conditions, cutting operating costs, reducing the reject rate. And in that BIPEL can help not only with a series of presses, but by providing a complete system of hydraulic moulding; modern, practical, economical.

Modern in conception. BIPEL presses provide for the first time three moulding pressures for each type of press. Three types between them provide nine pressures ranging from 20-300 tons.

Modern in performance. BIPEL auto-control of the moulding cycle can reproduce 'breathing,' 'dwelling,' and any conceivable moulding cycle. Automatic press-button operation leaves no room for human error, ensures the production of mouldings of standard excellence.

Modern in appearance. BIPEL presses with their clean lines contribute to a neat moulding-shop layout. Whether line-fed or with self-contained drive unit, unsightly pipes are eliminated, air temperature is reduced and working conditions are improved.

The photograph shows part of the installation of BIPEL presses at the Colne, Lancs. works of The British Thomson-Houston Co. Ltd. Here are shown one Type 100 and eight Type 40 presses; each has a self-contained drive unit, chosen to allow maximum flexibility of layout.

It pays to

Invest in THE BIPEL SYSTEM *of hydraulic moulding*

B.I.P. ENGINEERING LTD.,
ALDRIDGE ROAD, STREETLY, STAFFS.

'BIPEL' is a Registered Trade Mark

B·I·P

World patents granted or pending

Latest Products of the R.H. Cole Group

RHC RECLAMATIONS

Are now in full production of reclaimed

POLYTHENE
POLYSTYRENE
CELLULOSE ACETATE

In addition to their established range of virgin materials R. H. Cole now offer ex stock reclaimed plastics of especially high quality

LATEST EQUIPMENT AND CONSTANT LABORATORY CONTROL ENSURE BULK OUTPUT TO UNIFORM STANDARDS

R. H. COLE & COMPANY LTD
2 CAXTON STREET · WESTMINSTER · LONDON · SW1
Telephone: ABBey 3061 (10 lines)
Telegrams: GERATOLE, PHONE, LONDON

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 720,895. Continuous-flow dropper devices. E. N. Croce (Italy).

Preferably moulded of polyethylene ("Alkathene") to form a hollow conical spout attached to a cover with a capillary hole in the cover and an air tube on one side reaching into the bottle.

B.P. 720,922. Marbleizing plastic sheet. To: Union Carbide and Carbon Corp. (U.S.A.).

Hot granular thermoplastic material and cold short strips of coloured thermoplastic material are fed to the first bite of a calendering operation. The longitudinal axis of each strip should be parallel to the calendering rolls. The resulting sheet is folded and fed into the second bite. Vinyl chloride and vinyl acetate are mentioned.

B.P. 720,928. Cap for the closure of containers. A. Savary.

Contains a sealing disc with a thin flexible flange.

B.P. 720,962. Insulating end sleeves for electric cables and method of making same. E. Montanari (Switzerland).

From a synthetic resin applied in a liquid or pasty state and allowed to solidify so as to closely and elastically fit the cable end without adhering to it. Polyvinyl chloride, alkyl polysulphide, polythene and similar substances are suitable.

B.P. 720,969. Ball. J. Rasch, Rex-Thermoplastic Johannes Rasch (Germany).

Made without a rubber bladder from a mixture of 50-60% polyvinyl chloride and 50-40% plasticizer.

B.P. 720,999. Shade assembly for light sources of tubular shape. A. Wiig, M. V. Thomstad (Norway).

With H-shaped clamp having a springy intermediate portion to embrace at least 200 deg. of the circumference of the lamp tube.

B.P. 721,036. Closures for collapsible tubes containing pasty substances. F. Rueff (France).

An elastic sleeve is pushed over the neck holding a cap attached to the sleeve tight over the opening of the tube. The sleeve is slotted so that on pulling the cap off and aside the neck penetrates the elastic slot and the tube is then open. A small tube may be fitted into the opening projecting beyond the neck and carrying the cap.

B.P. 721,048. Helmets, more particularly miners' helmets. D. Burgess, D. G. Kenworthy.

Moulded with a reinforced strip adjacent the lamp-holding position with a slot to receive the tongue of the lamp and with a supporting face below the slot.

B.P. 721,050. Thermosetting resinous compositions. P. M. Fisk, H. G. Emblem. To: Kelsey Industries, Ltd.

An adhesive composition to be employed instead of solder to fill in imperfections in the surface of sheet steel articles (motor car industry) is made from an ethoxyline resin as one of the components.

B.P. 721,194. Production of films. L. A. Bashford. To: Courtaulds Ltd.

A cellulose acetate solution is extruded through a slit into a coagulant bath containing potassium acetate.

B.P. 721,205. Bends uniting side pieces of timber. N. Turner. To: National Research Development Corp.

A urea formaldehyde resin glue is used.

B.P. 721,211. Impregnation of porous solids with other materials. E. D. Tingle. To: National Research Development Corp.

Polytetrafluoroethylene (p.t.f.e.) to improve anti-frictional and wear-resisting characteristics, e.g., for a porous carbon (electrical) brush or a bearing.

B.P. 721,217. Injection moulding apparatus. L. R. Brazier. To: Dunlop Rubber Co., Ltd.

An injector is mounted on a carriage movable along a bank of independent stationary presses. Each press has at least two platens with means for attaching the parts of a mould to each pair of opposed platen faces.

B.P. 721,219. Production of friction material. H. J. Cofek. To: Raybestos-Manhattan Inc.

The principal binder is an aqueous solution of a thermosetting resin (alkali-catalysed phenol-formaldehyde aldehyde partial condensate).

B.P. 721,303. Surface treatment of leathercloth. T. R. Evans, W. H. Hogg. To: Dunlop Rubber Co., Ltd.

"Antiquing" (darken the hollows of an embossed pattern) of polyvinyl chloride leathercloth is carried out by applying a gel of vinyl chloride copolymer in which a colouring material is incorporated.

B.P. 721,305. Manufacture of moisture-proof sheet wrapping material. W. Berry, C. R. Oswin, R. A. Rose, C. R. Bruce. To: British Cellophane, Ltd.

The base sheet is a hydrophilic, water insoluble, non-fibrous cellulose derivative or polyamide (add to B.P. 669,907).

B.P. 721,326. Moulding of polymeric materials. S. Holt, G. Mercer. To: I.C.I. Ltd.

The method relates to single or small numbers of mouldings without exposing the molten material (linear polyamide or polyester) to oxygen, without contamination of the material by the walls of the moulding apparatus and without the need for cleaning the apparatus after each moulding. A pack is formed from material by completely wrapping it in a protective sheet, heating the pack in a metal chamber and then subjecting it to pressure so that the material flows through a duct to the mould after the wrapping has been pierced near the duct.

B.P. 721,340. Resin and synthetic rubber mixtures. To: United States Rubber Co. (U.S.A.).

Polyvinyl acetal resin with butadiene elastomer.

B.P. 721,341. Production of self-extinguishing moulded articles. T. C. Baker. To: Allied Chemical and Dye Corp.

The composition is made up of antimony trioxide with a polymerizable unsaturated alkyd.

B.P. 721,362. Microporous materials. J. C. Duddy. To: Electric Storage Battery Co.

Separators of polyvinyl chloride resins have been rendered inert to attack by the chemical conditions in certain batteries by impregnating the microporous material with monomeric styrene which is at least partly polymerized in situ.

B.P. 721,377. Rotary-mould-table injection moulding machines. L. R. Brazier. To: Dunlop Rubber Co., Ltd.

Stationary electrical induction heating elements are arranged along the circular path described by the moulds and maintain the material in the moulds at moulding temperature.

B.P. 721,403. Eye shields. A. F. Parmelee. To: Parmelee Plastics Co.

A hinge assembly for securing a temple bow to the frame of an eye shield.

B.P. 721,413. Extrusion press for thermoplastic material. To: N.V. Onderzoekings-instituut Research (Netherlands).

When feeding polyamide grains, especially of non-spherical shape, to the horizontal extrusion screw such grains often get stuck between screw and wall. When giving the wall of the filling chamber a special shape where it leads the grains into the screw such difficulties do not occur.

B.P. 721,447. Method of making laminated structures. S. A. Leader. To: P. D. S. Young, D. A. Leader.

Pretreated (impregnated) sheets are wetted with a polymerizable liquid ester and maintained in contact till the ester has polymerized.

B.P. 721,485. Polyvinyl chloride-coated laminated fabric conveyor belting. L. Landau, F. T. Berry. To: Barrow, Hepburn and Gale, Ltd.

The reinforcement is formed and coated in one uninterrupted operation.

B.P. 721,510. Method of protecting the interior surfaces of oil tanks from corrosion. G. May, W. V. van Gennep. To: V.G. (London), Ltd.

A high-alumina cement admixed with an aqueous oil-resistant synthetic-resin emulsion adapted to key the cement to a metal surface applied in two or more thin layers. A tough woven layer is sandwiched between them.

B.P. 721,527. Box. H. Kruft (Germany).

A circular box for sewing needles with a rotatable rim part and openings for a needle.

B.P. 721,609. Moulding hollow articles, particularly from synthetic thermoplastic resins. H. N. Ewer. To: G. and E. Equipments and Contracts, Ltd.

Polythene articles are made by injection of the material into a mould consisting of at least two parts and a core, the support of which permits the passage of the material. The article is removed from the mould together with the core, divided into its components, then the core is removed and the components joined together. Used, e.g., for toys.

B.P. 721,635. Blends of resins and elastomers. To: United States Rubber Co. (U.S.A.)

Vinyl chloride polymers with minor amounts of a rubbery copolymer to obtain non-brittle, tough, rigid articles as chemically and heat resistant as polyvinyl chloride itself.

B.P. 721,641. Polymerization of methacrylic esters. H. J. Stern, L. E. Shadbolt,

W. L. Rawitzer. To: Dental Fillings, Ltd.

For dental work, polymerization can be carried out at room (body) temperature by the use of a selected mercaptide in conjunction with a peroxide catalyst and a trace of copper compound.

B.P. 721,660. Resinous layers having a selected degree of water sensitivity and method of making same. To: General Aniline and Film Corp. (U.S.A.).

B.P. 721,662. Method of checking the creeping of cores within the sheaths of electric cables. J. E. Deering. To: H.M.'s Postmaster-General.

Part of the sheath around the cable is removed to expose the core, a polyethylene tape is wound upon the exposed portion and the adjacent parts of the sheath, then a blowpipe is used and the polyethylene softened. Finally a mould is clamped round the mass to form it into a muff.

B.P. 721,663. Method of joining electric cables. J. E. Deering. To: H.M.'s Postmaster-General.

B.P. 721,664. Adjustable moulding device for moulding a roll of plastics material about a longitudinal core. J. E. Deering. To: H.M.'s Postmaster-General.

B.P. 721,665. Method of sealing sheathed electric cables. J. E. Deering. To: H.M.'s Postmaster-General.

B.P. 721,692. Manufacture of hollow articles from thermosetting resin and fibrous material. J. Rees, G. C. E. B. Hulbert. To: Bristol Aeroplane Co., Ltd.

Refers in particular to the manufacture of radomes from glass fibre cord wound on a former which is then lowered into a mould with a quantity of uncured liquid resin of the cold setting type.

B.P. 721,705. Moulding elongated shapes from polytetrafluorethylene. To: Polymer Corp. (U.S.A.).

Measured charges of p.t.f.e. powder maintained in fluffy condition in a hopper is intermittently supplied into a forming tube and forced through a heating zone in that tube by a reciprocating plunger. The formed rod is intermittently advanced and pushed out of the discharge end of the tube.

B.P. 721,714. Heat-sealable laminated or coated wrapping material. British Sidac, Ltd., R. T. K. Cornwell.

A hydrophilic base sheet of regenerated cellulose conditioned by a uniformly distributed thermosetting resin in the thermoset state, and a coating of polythene anchored to the base by the thermoset resin (solution of a polymerized melamine-formaldehyde product).

B.P. 721,824. Heat transfers. Lacrinoid Products, Ltd., H. Meyer.

The transferable layer is a mixture of a thermosetting melamine-aldehyde resin (50-95%) and a thermosetting alkyd resin (50-5%), converted into hardened form after application to the permanent support.

B.P. 721,863. Spinning nozzles. G. Aschenbrenner, B. Wempe (Austria).

The spinning head is secured to the spinning plate by shrinking the head around the plate. The parts may be made of any of the known materials including plastics. Phenol-formaldehyde condensation products are mentioned.

B.P. 721,902. Process for moulding or processing a sheet of "plastic" into shapes. J. A. Whittall. To: Arley Fabrications, Ltd.

The moulding tool (former) is made of a material which is a bad heat conductor. It is left in moulding position till the plastic sheet (Perspex), stretched in heated condition over the former, has cooled and set. For panels, doors, trough-shaped in cross-section.

B.P. 721,908. Process for the production of polyethylene dispersible in water. W. Spindler, W. Scheermesser (Germany).

B.P. 721,949. Leaf-spring asemblies. P. P. Love. To: Glacier Metal Co., Ltd.

A matrix, e.g., a strip of porous sintered copper or a resin-bonded fabric, is impregnated with p.t.f.e., which acts as bond for, or between, p.t.f.e. surface layers on both sides of the matrix to form an interleaving material for lubricating the spring assembly.

B.P. 722,072. Valve-operating mechanism for gas meters. To: Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz (France).

The crankshaft bearings, complete with bosses for locating them, are formed as a one-piece unit of self-lubricating plastics material moulded by injection.

B.P. 722,091. Manufacture of anti-corrosive linings for apparatus. To: Farbwerke Hoechst A.G. (Germany).

Entirely different physical properties of the exterior parts of an apparatus (steel, iron, copper, reinforced concrete and masonry) and of a brick-lining, or of layers of superposed stone plates, demand a thick lining and a thick jacket and make the apparatus expensive while reducing its capacity. These drawbacks are overcome by a lining of thin plates made from condensation products of mononuclear monohydric phenols and formaldehyde with certain fillers. Phenol-formaldehyde resins are used as cement.

B.P. 722,239. Combined bell-push and indicator plate. A. Barton, P. L. Barton.

In a one-piece or two-piece (plate and cover) plastics moulding with an illuminable bell-push assembly.

B.P. 722,267. Mouldable compositions. T. S. Simpson. To: Bakelite, Ltd.

A thermosetting unsaturated polyester resin in intimate association with a polyester filler in filament, yarn or fabric form (Terylene).

B.P. 722,292. Production of glass fibre polyester-resin products. To: Atlas Powder Co. (U.S.A.).

Reinforcing glass fibres and solid, uncured, polymerizable resin cementing the fibres together form a superficially dry, pliable mat. This may be fitted into moulds and cured.

B.P. 722,111/112. Manufacture of plastics handles for cutlery and hand tools. A. Krausz, N. Krausz, Harris Miller and Co.

The parts (knives, tools) are placed in recesses of a mould with their tangs projecting into the closed cavities for the handles. The plastics material is injected through channels.

B.P. 722,128. Markers for electrical conductors, such as cables, flexible tubes, pipes, and the like. N. O. T. Lööf (Sweden).

A tubular longitudinally split rider gripping resiliently the conductor with a longitudinal flattened recess on top for inserting a label and a transparent cover strip. Made from extruded plastics sections cut into appropriate lengths.

B.P. 722,320. Construction of chemically resistant reaction chambers or towers. P. Guareschi (Italy).

A framework supports walls made from heat-weldable thermoplastic synthetic resinous materials (polyvinyl resins) employed in the form of sheets freely suspended from the top of the framework and welded together at their connecting edges as a closed curtain within the framework and attached to it by stirrup-like parts of the same material welded to the curtain.

B.P. 722,347. Portable containers. G. Blagdon.

For carrying miners' detonators, a moulded one-piece oblong casing with vertical partitions for the reception of a detonator, and a lid of transparent plastic hinged to one side forming a sealed closure and incorporating a lock.

B.P. 722,409. Metallization of flexible sheet materials. R. D. Brace, R. W. Maxwell. To: I.C.I., Ltd.

A transfer foil, e.g., a "Cellophane" sheet of less than 0.002 in. thickness metallized with aluminium by thermal evaporation, is pressed on to a fabric coated with an adhesive, e.g., "Vulcaprene A" or "Vulcafor V.C.N." After drying and curing, the material is embossed and the "Cellophane" stripped, leaving the metal film on the coated fabric.

B.P. 722,414. Treatment of hydrophilic solid substances or materials to promote their adhesion to other materials. To: Bjorksten Research Laboratories Inc. (U.S.A.).

Glass fibre laminates have highest strength properties but are greatly weakened on immersion in water due to the hydrophilic properties of glass or filler surfaces. These hydrophilic substances are provided with an alkenyl halo-silane coating, then washed to remove halogen atoms. The treated fibres are laminated or coated with a plastic (particularly satisfactory are unsaturated alkyds).

B.P. 722,423. Packages for fragile articles. C. L. Smith. To: E. S. and A. Robinson, Ltd.

For packaging, e.g., glass ampoules. Two moulded transparent cellulose-acetate or other plastics sheets with complementary recesses for the articles and outward flanges projecting beyond the bottom of the recesses secured together by adhesive tape.

B.P. 722,431. Spraying device. L. E. Witney. To: Industrial Appliances, Ltd.

A flexible (polythene) container with a spray cap and a tube projecting therefrom into the container. The cap has a passage with a tapering roof leading to the discharge orifice.

B.P. 722,491. Hypodermic injection devices. J. H. M. Lyons.

A container of flexible plastics with a closed nipple and a needle-mounting adapter. The adapter is provided with a hollow needle to pierce the nipple when assembled for use.

B.P. 722,505. Polyvinyl compositions suitable for the production of moulded products. W. Saul, T. J. Wiggins, E. Linley. To: Semtex, Ltd.

An aqueous dispersion of a polyvinyl compound and water gas pitch.

Plugging on

Twenty-three years ago, Exide Batteries led the field by introducing the plastics battery vent plugs shown on the right which we moulded in acid-resisting phenolic material. The job also entailed cementing together three parts to provide the trap to prevent escape of electrolyte. As new techniques and new materials became available, the vent plugs were redesigned and the most modern types, illustrated above, are moulded in two pieces only, using cream coloured polystyrene. Looking through our records recently, we find we have now produced several millions of these plugs, known throughout the world to users of "Exide-Ironclad" and "Chloride" batteries, and we reflect with pleasure upon yet another old friend well satisfied by Streetly Service.

MOULDED BY STREETLY

THE STREETLY MANUFACTURING CO. LTD.,

STREETLY WORKS, SUTTON COLDFIELD.

B·I·P

Telephone: Streetly 78411.

Telegrams: Bang Streetly.

"LET'S CALL IN THE LIVELY LADS AT LORIVAL!"

Plastic jobs are best left to Lorival, as many leading manufacturers have found to their advantage. They're lively lads at Lorival. And they've got what it takes to produce mouldings of high quality in large quantities at low prices.

Consider the following facts ... then -

call in Lorival's lively lads!

Production—Lorival have one of the largest and most modern moulding shops in the country.

Tools—Mouldings can't be better than the tools that produce them. Lorival employ many of the finest designers and toolmakers in the business.

Costs—Constant output—Lorival work a three-shifts production of 100 hours a week—lowers costs, speeds delivery.

How It's Done—Lorival don't just mould plastics to customers' requirements. They really get their teeth into the problem. Work out ways and means of simplifying production and saving you money. An interesting Lorival booklet—'How It's Done'—follows a plastic moulding job through from start to finish. Lorival will be pleased to send you a copy on request.

LS8

LORIVAL PLASTICS

UNITED EBONITE & LORIVAL LTD., LITTLE LEVER, NR. BOLTON, LANCS.

A Glass A.M.C 440A filled

ALKYD MOULDING COMPOUND

Under **PLASKON** Licence

Impact Strength } 8-12 ft.-lbs. per inch of Notch (Izod)

Other Features

Arc Resistance	Exceeds 180 seconds (A.S.T.M. D495-48T).
Fast Curing	$\frac{1}{8}$" thick disc cures in 20 seconds at 320° F.
Low Pressures	Moulding Pressure 1,500-2,000 lbs. per sq. inch.
Self Extinguishing	Satisfies A.S.T.M. D635-44.

PLASKON ALKYD Moulding Materials originally developed with such outstanding success for high electrical insulation work in the United States are now manufactured under licence in England by RESINOUS CHEMICALS LIMITED.

Samples and full technical details from the sole licensees in this country—

RESINOUS CHEMICALS LIMITED

BLAYDON · COUNTY DURHAM

Telephone : Blaydon 347-8 'Grams : Reschem, Blaydon-on-Tyne

RCL

Ebonestos are Proud —

that their reputation has earned for them the privilege of supplying the following world-famous undertakings with high-precision plastic mouldings:

Admiralty.
Admiralty Compass Observatory.
Air Ministry.
Electricity Boards.
General Post Office.
Ministry of Supply.
Allen West & Co. Ltd.
Arrow Electric Switches Ltd.
Artic Fuse & Electrical Mfg. Co. Ltd.
Automatic Coil Winder & Electric Equipment Co. Ltd.
British Mechanical Productions Ltd.
British Thomson-Houston Co. Ltd.
Bryce Ltd.
A. C. Cossor Ltd.
Crompton Parkinson Ltd.
Denis Ferranti Meters Ltd.
Dewrance & Co. Ltd.
"Diamond H" Switches Ltd.
Enfield Clock Co. (London) Ltd.
English Electric Co. Ltd.
Ferranti Ltd.
Griffin & Tatlock Ltd.
Hoover Ltd.
Johnson & Phillips Ltd.
K.D.G. Instruments Ltd.
Max Factor & Co. Inc.
Metropolitan-Vickers Elec. Co. Ltd.
Muirhead & Co. Ltd.
Negretti & Zambra Ltd.
Nettlefold & Moser Ltd.
New Switchgear Construction Co. Ltd.
Parmiter Hope & Sugden Ltd.
R. B. Pullin & Co. Ltd.
Reeves & Sons Ltd.
A. Reyrolle & Co. Ltd.
Ross Ltd.
Simplex Electric Co. Ltd.
Siemens Bros. & Co. Ltd., London
J. Stone & Co. (Deptford) Ltd.
The Britmac Electrical Co., Ltd.
The Horstmann Gear Co. Ltd.
The Plessey Co. Ltd.
The Strand Electric & Engineering Co. Ltd.
The Tintometer Ltd.
Trix Ltd.
J. H. Tucker & Co. Ltd.
Turnright Controls Ltd.
Vauxhall Motors Ltd.
Venner Ltd.
Westinghouse Brake & Signal Co. Ltd.
Winsor & Newton Ltd.

If it's mouldable — Ebonestos can mould it

EBONESTOS INDUSTRIES LTD.

EST. 54 YEARS

MOULDERS IN ALL PLASTIC MATERIALS AND EBONESTOS SPECIAL COMPOSITIONS

EXCELSIOR WORKS, ROLLINS STREET, NEW CROSS, LONDON, S.E.15

New Cross 2080 (20 lines)

BEETLE Polyester

gives you Quality

The durability, consistency and excellent electrical properties of the resins are the natural consequences of B.I.P.'s careful research and production control.

B.I.P.

gives you Service

You are invited to take advantage of the guidance that the B.I.P. Advisory Department will always give you on design, and technical and production problems. This is practical guidance that costs you nothing. From the first idea to the final product, B.I.P. will see that what money you spend on Beetle Polyester will be directed to your best advantage.

BEETLE *Polyester Resins*

Further details and technical literature from:
B.I.P. Chemicals Ltd.,
Tat Bank House, Oldbury, Worcs.
London Office, 1 Argyll Street, London, W.1.

B·I·P

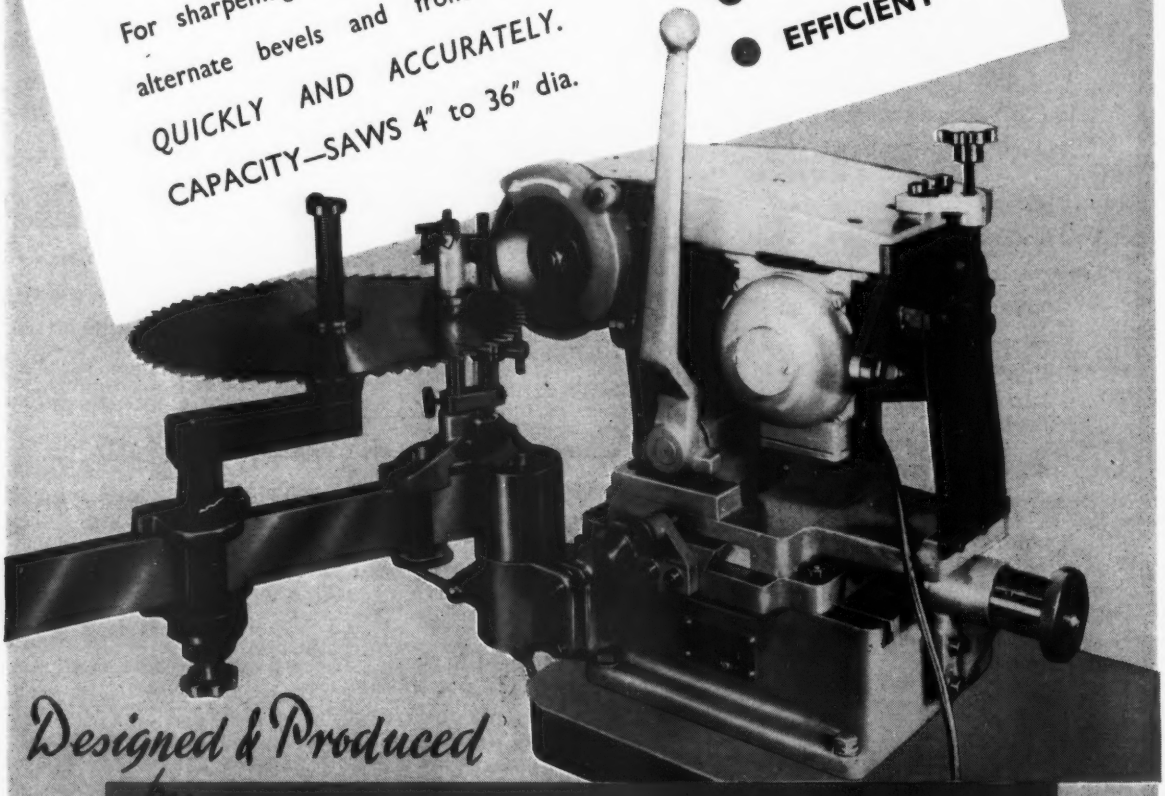
MORE IMPORTANT THAN EVER

A SHARPENING MACHINE

"MITIA" FOR CARBIDE TIPPED SAWS

For sharpening straight top teeth, alternate bevels and front faces QUICKLY AND ACCURATELY.
CAPACITY—SAWS 4" to 36" dia.

- ECONOMICAL
- RAPID
- ACCURATE
- EFFICIENT



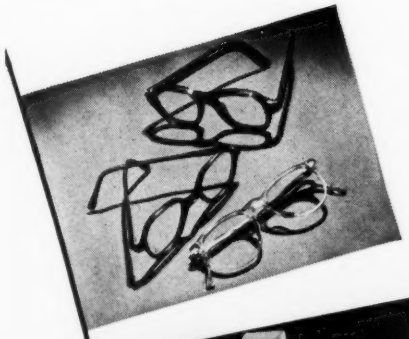
Designed & Produced by

FBT

FIRTH BROWN TOOLS LTD.

SPEEDICUT WORKS, CARLISLE STREET EAST,

SHEFFIELD . ENGLAND



First in the field and Still leading . .

'Celastoid'

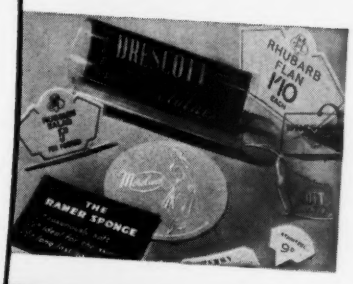
TRADE MARK

SLICED ACETATE

SHEETS

for colour, clarity, sparkle & high polish

'Celastoid' Sheets are available in standard sheet sizes 49″ x 21″, 52″ x 24″, and 56″ x 25″ approximately, in thicknesses of 10/1000″ upwards. 'Celastoid' Sheets are washable, durable and can be supplied in several finishes—in clear transparent and in black, white and clear, translucent or opaque colours. Among the many uses for 'Celastoid' sheets are :—



- **SPECTACLE FRAMES**
  In flesh pink, ice blue, crystal, and other popular shades, and shell mottles 92, 94, 97. Also tinted sheets for sunglass lenses. The new two colour lamination sheets for really lovely frames are now available. Spectacle frames in 'Celastoid' keep their shape, and are durable and completely *safe*.
- **DISPLAY FIGURES**
  Display figures like this, formed from 40/1000″ 'Celastoid' Sheet whether clear or spray-finished, give added sales appeal to lingerie for window display, showrooms, etc.
- **MACHINE GUARDS**
  Supplied in thicknesses up to 6 mm., 'Celastoid' is ideal for machine guards of all types, because of its toughness, durability, transparency, and because it can easily be formed to simple or compound curves.
- **LAMPSHADES**
  In a range of translucent pastel colours. Thicknesses 10/1000″ and 12½/1000″. Lampshades made from 'Celastoid' Sheet are washable and can be pleated, embossed printed or flock-sprayed.
- **LABELS, PRICE TICKETS**
  Can be printed in multi-colours, engraved or embossed. Labels and tickets of any shape can be blanked or formed from 'Celastoid' Sheet, and bring originality and brightness to merchandising.
- **PROTECTIVE EYEWEAR**
  Face shields and goggles made from transparent 'Celastoid' Sheet provide safety in industry without reducing efficiency—they are crystal clear, washable and *shatterproof*.

The Services of our Technical Development Section are freely available for consultation.

BRITISH CELANESE LIMITED

Plastics Division, Celanese House, Hanover Square, London, W.1.

SYNTUBE

Announcing . . . . . .

UNPLASTICISED P.V.C.

chemical plant and non-toxic grades in diameters up to 12" (all to Continental Standards). This is the ideal corrosion-resistant material for effluent, chemical products and fume extraction. Heavy-wall tubing is available for high pressure application; thin-wall tubing for fume ducting. Also flanges, fittings and connections.

POLYTHENE

tubing and fittings in all diameters up to 12". Manufactured to B.S.S. 1972 and 1973, 1953. Close tolerance tubing to customers' special requirements.

CELLULOSE ACETATE

tubing up to 8½" diameter available in transparent, translucent and opaque colours to suit special applications.

★ ★ ★

Our modern factory in the New Town of Bracknell has been specially designed for bulk production of large diameter synthetic tubing, fittings, and components. Our products are carefully controlled at all stages of manufacture to ensure superior performance, freedom from stress, and guaranteed quality. Enquiries are invited from chemical and petroleum engineers, chemical plant manufacturers, Government departments (and others) interested in atomic energy development and research. Our qualified technical representatives are available for discussions on design, installation, and all corrosion problems.

EXTRUDEX LTD

WESTERN RD., BRACKNELL, BERKS · TEL.: BRACKNELL 1000 · GRAMS: SYNTUBES BRACKNELL

Contractors to the Ministry of Supply, the Ministry of Works, the Admiralty, the Colonial Office, and Local Authorities.

Tough . . . *Transparent* . . . ***Oil-resisting***

That's 'Tenite' Butyrate . . . and that's why this versatile plastics material was chosen by G. E. Adams & Co. Ltd., of Coventry for the transparent domes of their gravity feed oilers.

These oilers are used on electric motors, line shafts and for practically every kind of ball, roller or ring oiled bearing. They are made to give years of service even in hot, dirty atmospheres.

From a production point of view, the remarkable moulding properties of 'Tenite' make it ideal for this particular job. Its natural resilience simplifies assembly and ensures the firm fixing of inserts.

'Tenite' Butyrate can help solve your production problems. Write for information and moulding samples to:

T.E.C. PRODUCTS DIVISION

Kodak LTD., KODAK HOUSE, KINGSWAY, LONDON, W.C.2
Telephone: Holborn 7841

Tenite BUTYRATE

'Tenite' is a registered trade-mark

If one green bottle...

should accidentally fall, or the whole ten, there would be no pieces to sweep up . . . because all Poly-Tainers are *unbreakable*. They carry creams, lotions, powders and chemicals in rigid or pliable Polythene . . . featherweight, airtight, acid resistant. We hold the world's largest range of stock moulds, all shapes, colours and sizes from ½ ounce to 15 gallons. Many world famous organisations use them. If you require a *special* Poly-Tainer we will make it for you. Our Design and Consultation Service is at *your* service. All "label" details can be embossed or printed direct by a new permanent process, in the colour you specify. That's **Poly-Tainer**!

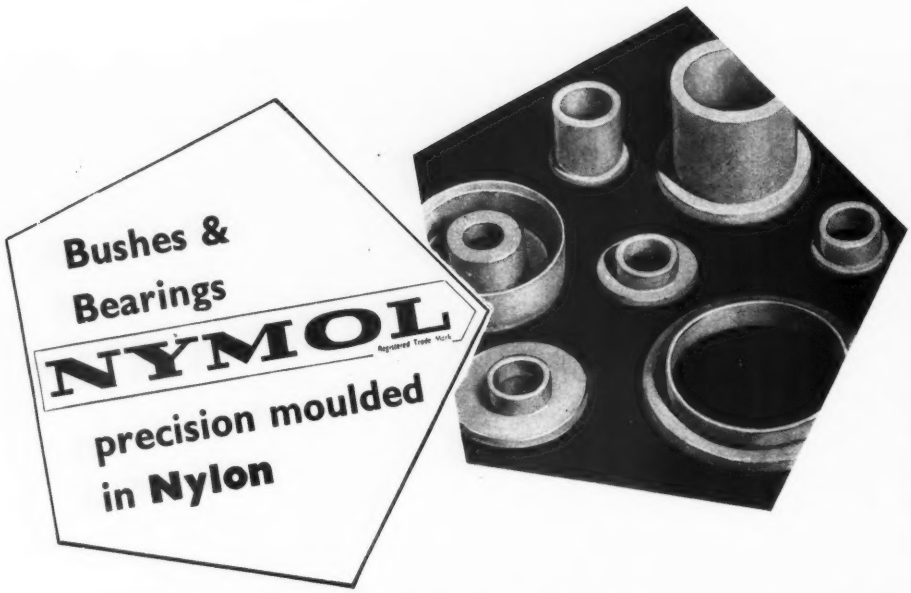
Poly-Tainer

Featherweight unbreakable leakproof containers.

THERE'S NO SUBSTITUTE

for a genuine Poly-Tainer.
Look for the name on the bottom.

Distributed by : **INDUSTRIAL APPLIANCES LTD., 21/22J Grosvenor Street, London, W.1.**
Telephone : GROsvenor 5976/7/8 (P.B.X.).
Manufactured by : **E. Shipton & Co. Ltd., Ferndown Works, Northwood Hills, Middx.**
Telephone : PINNER 1103/5 (P.B.X.).



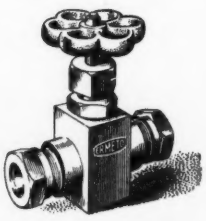
★ Nylon as a new engineering material, possesses, in high degree, the merits of Low Friction Coefficient, High Abrasion Resistance, and Resilience. In many cases it can also show appreciable cost advantage.

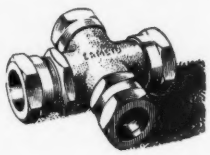
Plastic Engineers Limited

TREFOREST, GLAMORGAN
Telephones: Treforest 2371/2

Keeping Mechanical Power on the move!

In the building of powerful diesel engines Ermeto Valves and Couplings are a standard specification just as they are in scores of other industries. Renowned throughout the world for their vibration-proof and pressure holding qualities they are specified by designers and production engineers everywhere. The secret is in the Ermeto ring which cuts its own sealing flange as you tighten the locking nut.



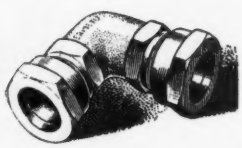


Ermeto joints have no equal.

ERMETO

Regd. Trade Mark

VALVES & COUPLINGS



BRITISH ERMETO CORPORATION LTD., MAIDENHEAD, BERKS, ENGLAND • Phone: Maidenhead 2271/4

BEST LAMINATING RESINS ARE...

Ferguson's

NESTOR

Brand

Cresol 50% Water Solution . . . Z.470
For impregnation and rapid cure.

Cresol 50% Spirit Solution . . . Z.439
For coating and high electrical.

Cresol Solid Resin Z.400
Soluble in spirit for coating and high electrical.

Send your enquiries to

James Ferguson & Sons Limited
Lea Park Works · Prince George's Road · Merton Abbey
LONDON S.W.19
Tel : MITCHAM 2283/7 *Grams : NESTORIUS, SOUPHONE, LONDON*

For Glass Reinforced Plastics of all types

Consult

MICROCELL

LIMITED

IMPERIAL BUILDINGS 56 KINGSWAY
LONDON, W.C.2
Telephone: Chancery 3424

Try this NEW tape

WATERPROOF – *it sheds water, stands up to weather*

TOUGH – *we have designed a dispenser to cut it easily, quickly and cleanly*

FLEXIBLE – *it "sits down" to bumps and dents, curves and angles*

ACID-RESISTANT – *safe against alkalis and solvents*

Rain or steam, humidity or dust, acids or bacteria - just one or the whole lot together; shut it OUT, shut them ALL OUT, with Transovil.

Prove it good. Let's send you a sample to test. Here is a real money-saving tape on which you can wholly rely, whatever the problem, however difficult the conditions. Transovil keeps flexible — doesn't harden or become brittle. In 72-yard rolls on 3" cores and 36-yard rolls on 1" cores.

Gosheron

WEATHERSEAL WITH TRANSOVIL

THE FINEST, TOUGHEST FILMIC TAPE OF ALL!

JOHN GOSHERON & CO LTD GAYFORD ROAD LONDON W 12 *SHEpherds Bush* 3326 & 6271 (*seven lines*)

DURESTOS

REGISTERED TRADE MARK

RESINATED ASBESTOS FELT MOULDING MATERIAL

Supplies are available in various grades, suitable for moulding by high, low and no pressure techniques. Mouldings made from Durestos felts are moderate in cost as compared with those from other types of laminates and in addition to a high strength/weight ratio they possess other exceptional physical properties, including dimensional stability and resistance to heat and mildew.

The illustration shows high-pressure mouldings manufactured from Durestos felt.

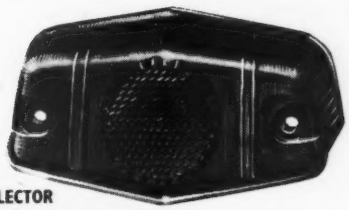
TURNER BROTHERS ASBESTOS CO. LTD. ROCHDALE ENGLAND

A MEMBER OF THE TURNER & NEWALL ORGANISATION

AF 18

3-WAY CONNECTOR COVER *IN HELVIN*

CABLE GROMMET *IN HELVIN*



REAR REFLECTOR *IN DIAKON*

BRAKE ADJUSTOR SHIELD *IN NYLON*

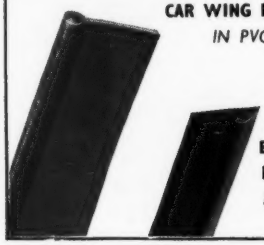
PLUG COVERS *IN HELVIN*

Plastic Components

for the motor industry

BODY FILLER BUTTON *IN HELVIN*

IGNITION WARNING LIGHT LENS *IN HELVIN*



CAR WING PIPING *IN PVC*

BUMPER EDGING *IN PVC*

DISTRIBUTOR SLEEVE FOR H.T. LEADS *IN HELVIN*

by **Hellermann LTD.**

(A subsidiary of Bowthorpe Holdings Ltd.)

CRAWLEY, SUSSEX. Crawley 2000/1/2/3/4

MELPLAS

Extruded Plastics

Rigid—and Flexible

M TP

FOR EVERY [illegible] MADE

MELWOOD THERMOPLASTICS LIMITED

WILLOUGHBY ROAD

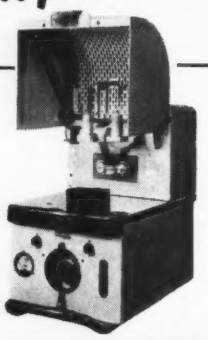
HARPENDEN · HERTS

TEL · HARPENDEN 300 GRAMS · MELPLAS · HARPENDEN

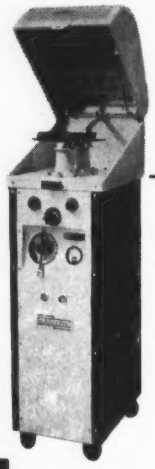
LONDON OFFICE · 49 LONDON WALL E·C·2 · MONARCH 6062

RADYNE sets the standard in DIELECTRIC PREHEATING

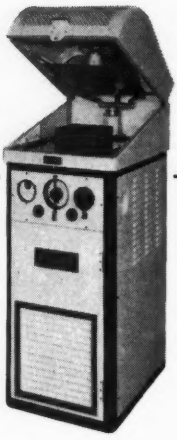
Four fine equipments to speed your production



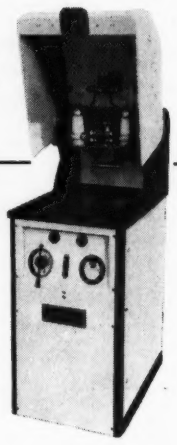
MODEL H5/A
Will fully plasticise up to 6 oz. of moulding powder per minute. Output 500 watts. Easily portable: weight only 180 lb.



MODEL H7/B
Will plasticise up to 1 lb. of wood-filled moulding powder per minute. Output 1½ kW. Weight 200 lb.: easily movable on rubber-mounted castors.



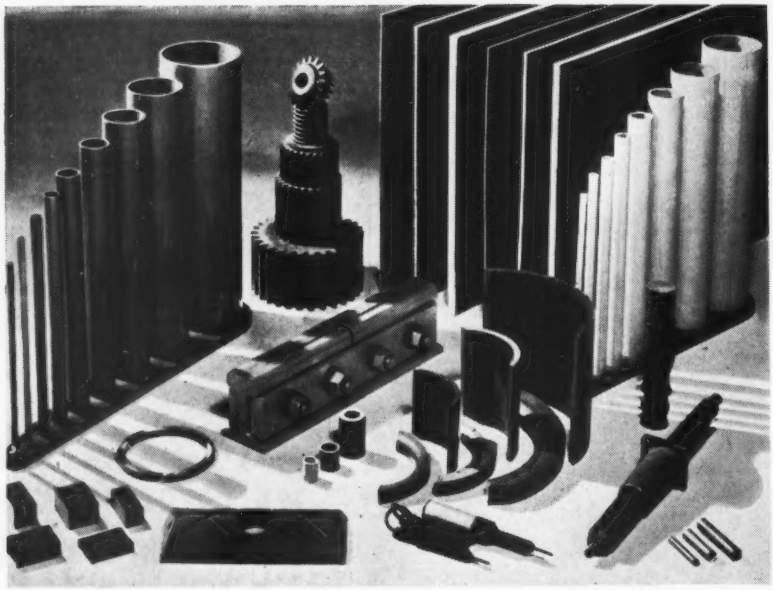
MODEL H25/A
Will plasticise up to 2 lb. of wood-filled moulding powder per minute. Output 3 kW. Weight 500 lb. Unit stands on rubber-mounted castors.



MODEL H50
A super speed high temperature pre-heater capable of heating 1 lb. of powder to 150°C in ¾ minute, or normally pre-heating 4 lb. in a minute. Output 6 kW.

radio heaters ltd.
WOKINGHAM · BERKS · ENGLAND
Phone: Wokingham 1030-1-2
Grams: Radyne, Wokingham

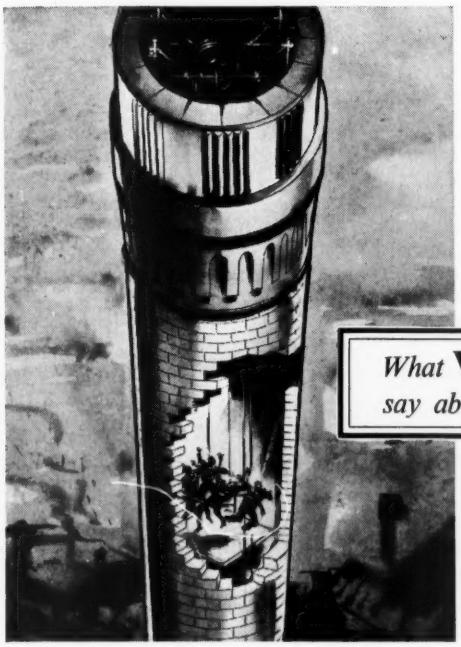
Formapex plastic laminates



For machined parts — gears, pinions, bearings, thrust washers, collars, valve seatings, etc., or jigs, FORMAPEX combines excellent machining properties with resilience, toughness, and a low coefficient of friction. It is supplied in sheets up to 7½" thick, in rods and tubes of round and rectangular section, and is highly resistant to moisture, dilute acids and organic liquids.

Paper based quality also available for electrical insulation work.

IOCO LIMITED, Anniesland, Glasgow, W.3
Telephone: Scotstoun 5501



THIS JAM WAS LETHAL

Four men descending from the top of a new 250 ft. chimney were riding on the platform of a materials hoist when it stuck for a moment and then suddenly dropped several feet. Two passengers were shaken off by the jerk and killed.

The hoist jammed owing to adjacent guides being of unequal thickness, and some slack ran out in the hoisting rope. The jam then cleared itself but the brake failed to hold the platform, and this ran free until the slack in the rope was taken up.

What **Vulcan** *say about it . . .*

Users of cranes and hoists seem unusually accident-prone. Safety regulations should therefore be prominently displayed and meticulously enforced. Only in a few strictly defined cases may anybody at all be conveyed on a materials hoist, and never more than two people.

Engineer-Surveyors from Vulcan Insurance not only test ropes, tackle and all the winding and braking machinery of the lifts and hoists they insure; they also give every assistance to engineers in safety education and in drafting notices to users. If you already know the pains they take over boilers you will surely welcome their attention to your lifts, hoists, cranes, and indeed all the plant and machinery in your care.

VULCAN INSPECTS—AND PROTECTS

THE **Vulcan** *67 King Street Manchester 2*

FREE. For news of industrial accidents and ways to avoid them, ask us now for "Vulcan"—a quarterly journal for Power users. Please write to Dept. 11.

BOILER & GENERAL INSURANCE CO. LTD

MOULDS & MOULDINGS

CASE DEVELOPMENT CO., LTD., KANGLEY BRIDGE RD., S.E.26

Battenfeld

ELECTRO-MECHANICAL SYSTEM

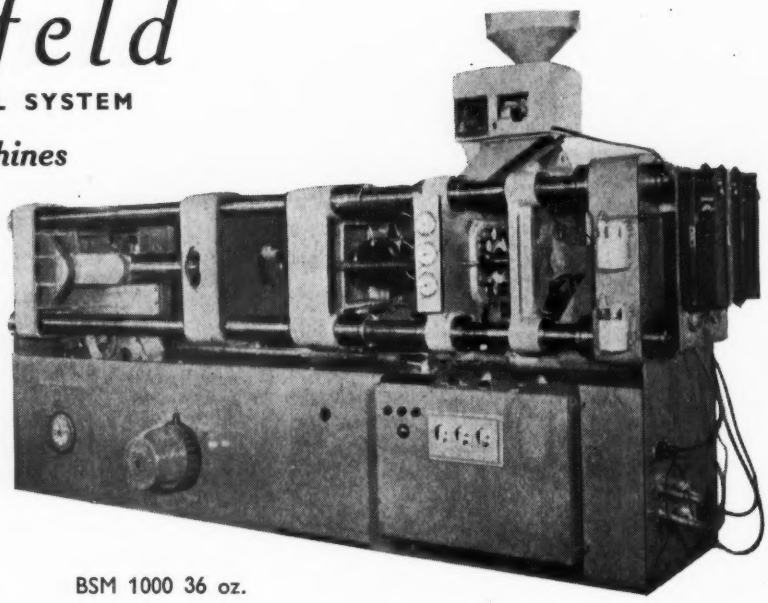
Injection Moulding Machines and Presses

MOULDERS

From 0.7 - 36 oz. per shot

PRESSES

From 10 - 200 tons pressure



BSM 1000 36 oz.

FOR PARTICULARS, APPLY SOLE AGENTS :—

ED. BRAND, LTD. (PLASTICS DIVISION) TELEPHONE : 9, ST. CROSS STREET, HATTON GARDEN, LONDON, E.C.1 CHA. 4091

Ether Wheelco ELECTRONIC CONTROLS

***. . . for closer* CONTROL *of injection moulding* TEMPERATURES**

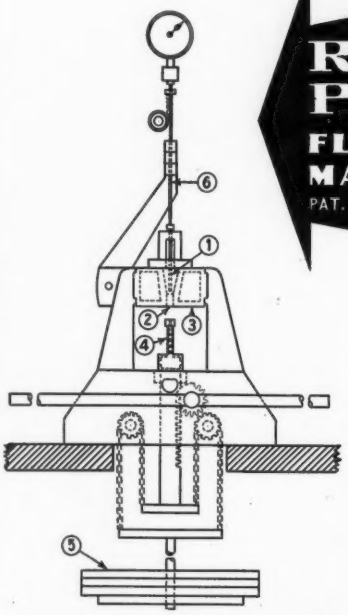
Most of the leading British and American Moulding Machines are fitted exclusively with Ether-Wheelco Electronic Controls for the automatic control of injection moulding machine nozzle temperatures. The "Capacitrol" (as illustrated above) controls electrically heated nozzle temperatures with the greatest speed and has greater accuracy than the mechanically operated type of apparatus. It is electronically operated, reliable, moderate in price. *Write for list No. 250*

ETHER LTD. TYBURN ROAD, ERDINGTON BIRMINGHAM 24 Phone: EAst 0276-7

PIONEERS OF INDUSTRIAL ELECTRONICS

Rossi Peakes FLOW TEST MACHINE

PAT. Nº 432646



1. Orifice in Split Cone
2. Charge Chamber
3. Steam Heated Block
4. Ram
5. Weights
6. Follower Rod

CUBAR

An improved method and apparatus for testing Thermosetting Plastic Materials; manufactured by Dunbar & Cook, Ltd., for Messrs. Bakelite, Ltd., and other important firms in the industry.

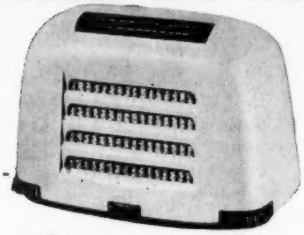
** Enquiries for price and delivery to:*

DUNBAR & COOK LTD

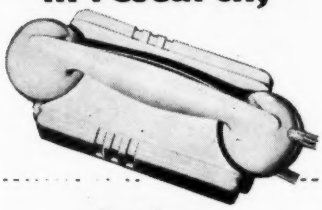
107-108 NEW JOHN STREET, BIRMINGHAM, 6

KM

points the way

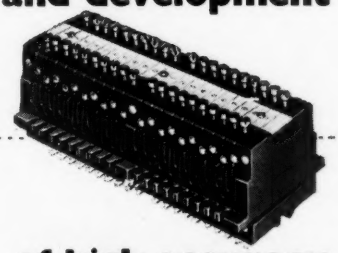


in research,



design,

and development



of high accuracy

plastic mouldings

KENT MOULDINGS invite your enquiries for injection, transfer and compression mouldings. K.M. engineers will be happy to examine any problem and give you sound and honest advice.

KENT MOULDINGS

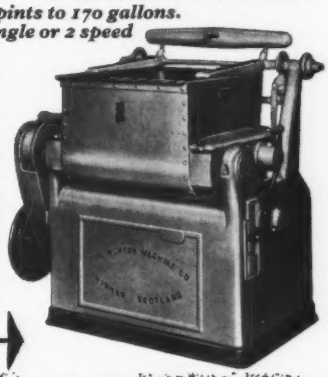
FOOTSCRAY, KENT Telephone: FOOtscray 3333

MIXING IS OUR BUSINESS

DUPLEX MIXERS

Range: 5 pints to 170 gallons. Single or 2 speed

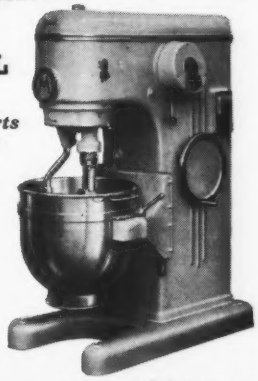
Can be adapted for Vacuum and/or pressure—tilting or non-tilting types. Machines can be modified to suit individual requirements. Steam or water jackets can be fitted. Machines Mild Steel, Stainless Steel or Brass construction. Part or whole Grid Lids can be fitted.



VERTICAL MIXERS

Range: 10 American Quarts to 120 Imperial Quarts

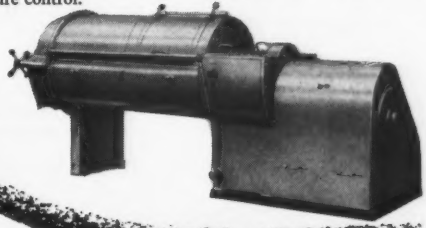
Designed for extremely heavy duty work. Easy to clean—Beaters quickly changed. Bowl Scraper saves scraping down by hand. "STOP" position to prevent beater creep. Shock absorbers in elevating mechanism.



TWIN WORM MIXERS

Two models 50 and 100 gallons

The ideal machine where an unusually homogeneous mix is essential, also suitable for mixing solids with solids or liquids with solids. Excellent for the mixing of Yeast, Chocolate, Baking Powders, Face Powders, Talcs, Cosmetics, Dyestuffs, Starches, Dry Battery Compound, etc. The machine is self-emptying—simply raise the discharge door and the beater blades force the contents through the opening. Can be jacketted for temperature control.



MORTON

MORTON MACHINE COMPANY LIMITED

Atlantic Works, Wishaw, Scotland

Telephone: Wishaw 700. Telegrams: Mortonmix, Wishaw

For PLASTICS MOULDS for all types of moulding, including injection moulding, at competitive prices and quick delivery . . .

ARPAL

BECKER & VAN HÜLLEN

. . . you can't do better than go to ARPAL who also supply the best PLASTICS PRESSES

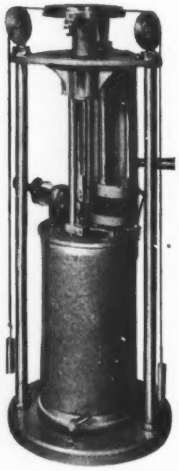
—a fact which is proved by the number of repeat orders

Sole Agents ARPAL (ENGINEERS) LTD.

ABFORD HOUSE, WILTON ROAD, LONDON, S.W.1 :: TELEPHONE: VICTORIA 2785, 4880, 0783

WALLACE
OF
CROYDON

Manufacturers of Test Equipment for Rubber and Plastics



A "Clash and Berg" TYPE Torsion Tester for Flexible Plastics

Designed to study and measure the stiffness characteristics of flexible plastics over a wide temperature range. The apparatus conforms with ASTM D 1043-51 and Draft British Specification CT/PLC/1413 Appendix L.

H. W. WALLACE & CO. LTD.
ST. JAMES'S ROAD, CROYDON, ENGLAND
CROYDON 0736, 4868 6969

NATIONAL COLLEGE OF RUBBER TECHNOLOGY

Holloway Road, London, N.7

The College is financed by the Ministry of Education, and supported by the Industry. In addition to training for the Diplomas of the College, the courses offered include :—

A.I.R.I.

Three-year full-time course. Qualification for entry—G.C.E. with at least two of the subjects, chemistry, physics and mathematics at Advanced Level, and the third studied to that level.

Associateship Course for Graduates

One year full-time course

L.I.R.I.

One-year intensive full-time course for those at ordinary G.C.E. level wishing to qualify for a position of subordinate responsibility in the rubber industry. Success in this course also qualifies for admission to the A.I.R.I. course.

Research Courses

Suitably qualified rubber technologists are accepted for specialised courses leading to fellowship of the National College (F.N.C.R.T.) and higher degrees by research.

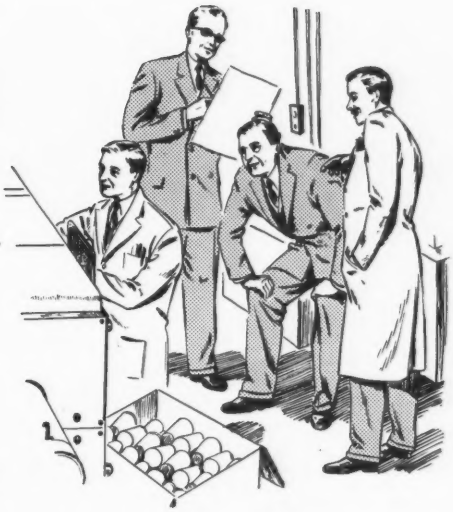
Prospectus, giving details of Scholarships and all full-time, part-time and evening courses, free on application.

LIFE TO-DAY—

is full of Plastic Mouldings

Many of them are by

J. F. KENURE



Mouldings in all thermoplastic materials up to 10 oz., including flexible moulding by the patented Kenutuf (P.V.C.) Process.

Tool design and precision mould making. Fully equipped modern tool room.

Capacity and facilities for fabrication, manipulation and assembly of plastic and metal components.

—CAN WE HELP WITH YOURS?

KENURE

J. F. KENURE LTD., FAGGS ROAD, FELTHAM, MIDDLESEX

Telephone: FELTHAM 2604/5/6

BETTER

TRY '600'

FIRST !

for

PLASTICS MACHINERY OF ALL TYPES

Including:

Two-roll Mixing Mills · Pre-form Tabletting Machines · Hydraulic Compression and Injection Moulding Presses · Extruders Pumps and Accumulators · Vulcanising Pans

Our range includes: Power Plant · Boilers Lifting and Mechanical Handling Equipment Protective Clothing

WOOD LANE, LONDON, W.12

'Phone: Shepherds Bush 2070. 'Grams: Omniplant, Telex, London

STANNINGLEY, Near LEEDS

'Phone: Pudsey 2241. 'Grams: Coborn, Leeds

GEORGE THE 600 GROUP OF COMPANIES **COHEN**

SONS AND COMPANY LIMITED

Established 1834

And at Kingsbury (Nr. Tamworth) · Manchester · Glasgow · Swansea · Newcastle · Belfast · Sheffield · Southampton · Bath

P/5412/HP68

STUCK

with a sticky problem?

We have been solving sticky problems since 1908. And to our knowledge we have never come unstuck! Big and small problems alike get our expert, specialised attention. Take for instance the task of providing the adhesive for the "Onazote" (product of the Expanded Rubber Co.) insulating panels of the massive Vickers-Armstrongs Stratosphere Chamber, or on the other hand the simple duty of providing an adhesive to stick the sole on "Miss Smith's" shoes. Both problems demand the utmost in perfection.

We can provide the *right* adhesive for any job —Industrial or Commercial.

However, should the right adhesive not be available from our impressively large range, Holdtite experts are at your service to produce a suitable adhesive, where possible, to suit your particular requirements.

You are invited to send samples of materials to be bonded: we will then advise the best adhesive to use.

HOLDTITE ADHESIVES

INCLUDE types for:—
Aircraft Industry · Boot and Shoe Industry
Coach Builders · Flooring Industry
Furniture Manufacturing · Motor Industry
Plastics Industry · Shipping Industry
Tiling, etc.

SURRIDGE'S PATENTS LTD

NEW WORKS · CROYDON ROAD
BECKENHAM · KENT
Telephones: BECKENHAM 0168 - 1313

MACHINERY for PLASTICS

Fusing Machinery for P.V.C.

Impregnating Machinery

Spreaders

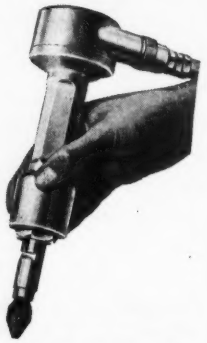
Baking Ovens

GREENBANK ENGINEERING CO. LTD. BLACKBURN

AJAX

Air Turbine

HAND GRINDERS FOR YOUR MOULDS



AJAX JUNIOR

Weighs only 8 oz. Speed approx. 90,000 R.P.M. For Grindstones $\frac{1}{16}$" to $\frac{3}{8}$" dia. Sturdy Spindle Collet bored for $\frac{1}{4}$" dia. shanks. Air Pressure required 50-100 lbs./sq. in.

Leaflets P2 and P3 on request.

Please state Air Pressure when ordering.

BRIGGS BROS. & CO.,
Ajax Works, Jakeman Rd.,
Birmingham, 12
Phone CALTHORPE 2995

AJAX II and AJAX III

Powerful, yet easily handled. Speed approx. 50,000 R.P.M. For Grindstones $\frac{1}{4}$" to $\frac{3}{4}$" dia. Collet bored for 6 mm. or $\frac{1}{4}$" dia. shanks. Air Pressure required 50-100 lbs./sq. in.

'HARCO'
PERFORATED METAL

Accurately perforated and extremely durable, 'Harco' Perforated Metal is produced in most metals for any grading, screening or sorting requirement. A wide range of plain, embossed and ornamental patterns is available.

Send for Catalogue No. PS 782.

Harvey

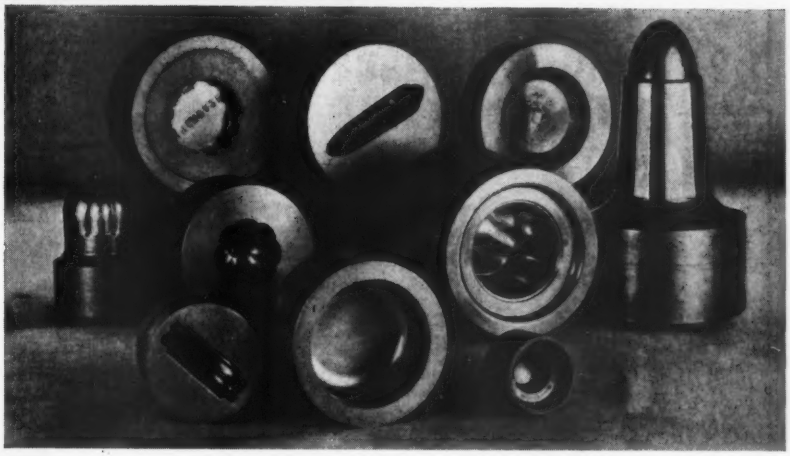
Telephone: GREenwich 3232 (22 lines)
G. A. HARVEY & CO. (LONDON) LTD., Woolwich Road, London, S.E.7

Hobbing can save you money on moulds

Consult us to see if we can hob your mould cavities. Expensive time spent on die-sinking can often be avoided.

★

First Class
Service
and Delivery



L. WHITING LTD.

• *Hobbers to the Trade* •

296, Latimer Road, North Kensington, W.10. *Telephone: LADBROKE 3521*

TRI-ALLYL-CYANURATE

2.4. DI-AMINO 6.CHLOR 1.3.5. TRIAZINE

2.AMINO 4.6. DI-CHLOR 1.3.5. TRIAZINE

BUSH BEACH & GENT LIMITED

OFFER SUPPLIES OF TRIAZINE COMPOUNDS FOR IMPROVEMENT OF TEMPERATURE RESISTANCE IN POLYESTER AND OTHER RESINS. SAMPLES AND QUOTATIONS ON REQUEST

MARLOW HOUSE, LLOYDS AVENUE, LONDON, E.C.3

Phone: ROYal 7077/8/9 & 3057/8 Grams: Beafredma Fen London.

CANNING

SATENE

A superior greaseless composition for removing scratches or moulding marks and producing an attractive satin or matt finish on plastics.

Available in 3 lb. tubes.

W. CANNING & CO. LTD. BIRMINGHAM, 18

Wanted STOCKS for CASH

We are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus and Redundant Stocks, **BOTTLES, Jars, Screw Caps, Cartons,** and other **Packaging Materials.** In fact, goods, of all kinds can be disposed of through us without delay, on the most favourable terms, and without trouble.

Should you have anything for disposal either now or at any future time please send us samples, full particulars and price on a cash settlement basis and the matter will have our immediate and careful attention.

RELIANCE TRADING CO.

13, NEW COLLEGE PARADE, FINCHLEY RD., LONDON, N.W.3

Phone: PRIMROSE 5611 & 3167. *Grams:* "GORDON" PRIMROSE 5611

Pioneer Plastic House

NOTED FOR TECHNICAL ACCURACY AND DELIVERY. OVER 40 YEARS' EXPERIENCE. WE POSSESS A WELL EQUIPPED TOOL ROOM AND DEAL WITH REALLY DIFFICULT SUBJECTS.

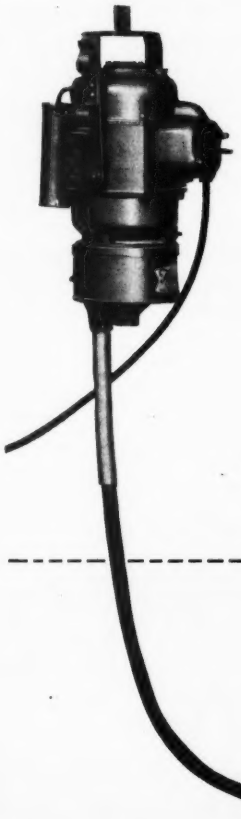
Address enquiries to

MOULDING DEPARTMENT ← → **TURNING AND MACHINING DEPARTMENT**

W. H. TANT & CO. LTD.

DOLLMAN STREET, BIRMINGHAM, 7

Phone: ASTon Cross 3232



A special handpiece for HIGH SPEEDS

This new handpiece, Type FBG/G, has been introduced for use with Tungsten carbide burs. When used on Flextol machine type CRF250, with a shaft speed of 10,400 r.p.m., a final spindle speed of 27,000 r.p.m. is provided. This handpiece, which is interchangeable with the standard type FBG, is provided with a hardened steel collet to take 6 mm. or ¼ in. shanks and has a cooling device to prevent wear on the high speed shaft.

Flextol
POWER-DRIVEN HAND TOOLS
Regd Trade Mark

FLEXTOL ENGINEERING COMPANY LIMITED

The Green, Ealing, London, W.5 *Telephone: EALing 6444-7*

Midlands: W. A. SIMPSON, 9 HILLSIDE AVENUE, MAPPERLEY, NOTTINGHAM. *Arnold 63273*
North: J. H. BOGG, 19 HOWARD ROAD, NORTHENDEN, MANCHESTER. *Wythenshaw 3061*
West: T. SHEPPARD, 17 STRADBROOK AVENUE, KINGSWAY, BRISTOL, 5.
Scotland: G. K. BAILLIE, 66 CRAIGLOCKHART ROAD, EDINBURGH, 11. *Edinburgh 88345*
Home Counties, North of Thames: G. J. HIRD, 60 BASILDON AVENUE, ILFORD.
Home Counties, South of Thames: J. M. DAVERS, 45 THE AVENUE, CHISWICK, W.4.

Are You Buying

B.L.C.
(EXPORTS) LIMITED

92 BAYLIS ROAD
LONDON S.E.1

TELEGRAMS BALACA
TELEPHONE WATerloo 3617-7

HOME AND EXPORT

the **RIGHT** *Quality at the* **RIGHT** *Price?*

for **ALL THERMOPLASTICS**

CELLULOSE ACETATE · BUTYRATE
POLYSTYRENE · P.V.C., etc., etc.

DIXONS OF HALIFAX

★ **Wire Shapes**
FOR THE PLASTICS TRADE

ARTHUR DIXON & CO. LTD.
RAGLAN ST., HALIFAX, YORKS
Halifax 3339 & 5249
103 GEORGE STREET, CROYDON
SURREY Croydon 3814

M.C.M.
(TOOLS) LTD.

Designers and Toolmakers
for Compression, Transfer and Injection Moulds, Pressure Die Casting Tools, Jigs and Fixtures
Let us solve your difficulties

M.C.M. (Tools) LTD. 12, Denmark Street, Aston
BIRMINGHAM, 19 *Aston Cross 1878*

TUFFLEX

EXTRUSIONS
are our business . . .
Not just a department

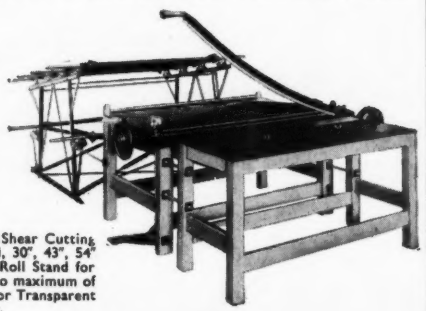
AS the leading specialists in this field our technical staff welcome enquiries for all types of extruded plastics. We can promise you also keen personal service and a completely satisfactory product.

C&C MARSHALL LTD

PLASTRIP HOUSE, OAKLEIGH ROAD NORTH, LONDON, N.20
Telephone : Hillside 5041 (3 lines). Telegrams : Tufflex, Norfinch, London
Cables : Tufflex, London

SHEAR CUTTING MACHINERY *for* Cutting Sheet Plastics and Rubber, etc.

T. KENDELL & SONS LTD.
Established 1840
FRENCH PLACE, LONDON, E.1.



Model No. 1 Hand Shear Cutting Machine, 30", 43", 54" and 60" length of cut.

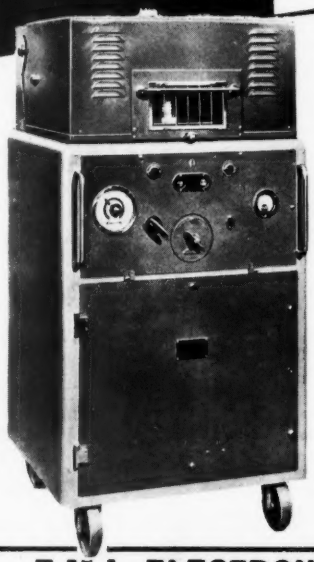
Shear Machines, Bench and Floor Models. From 3" to 114" Length of cut. Many other Machines for Your Trade.

Model No. 1 R.F. Hand Shear Cutting Machine with Roll Stand, 30", 43", 54" and 60" length of cut. Roll Stand for any number of rolls up to maximum of six. Specially suitable for Transparent Film, etc.

E·M·I

HIGH FREQUENCY HEATERS

FOR THE PLASTICS INDUSTRY



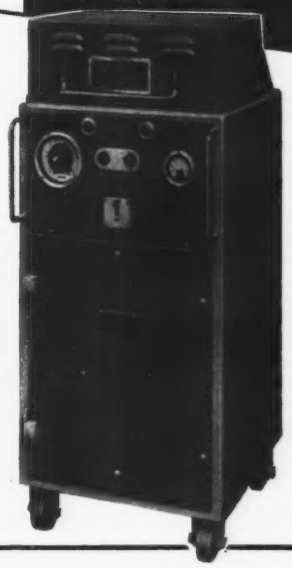
The special features of the E.M.I. Radio Frequency Heaters are:

- ★ Low running and maintenance costs.
- ★ Immediate servicing facilities.
- ★ Simplicity of operation.
- ★ Versatility.
- ★ Robustness.
- ★ Backed by sound technical advisory service.

RFH/1 *(Illustrated right).* 1 Kw. (58 BTU per minute). Oven will handle 2 lbs. powder. Heating rate 12 ozs. G.P. Moulding Powder per minute through 100°C.

DH 35A & B *(Illustrated left).* 3½ Kw. (200 BTU per minute). Oven size 18" x 18". Heating rate 2½ lbs. G.P. Moulding Powder per minute through 100°C. Available with either single or dual timer control panel.

For full details of H.F. Heating equipment:-



E.M.I. ELECTRONICS LTD. HAYES, MIDDLESEX. Telephone: SOUTHALL 2468 Ext. 473

Cellulose Acetate Plastics

By Vivian Stannett

THIS IS THE First Book to be entirely devoted to a thorough technical survey of the properties and potentialities of this well-known thermoplastic. It is designed to be of equal interest and value to the business man and the engineer or chemist, and includes a chapter on packaging and container applications.

Illustrated, 30s. net, by post 30s. 8d.

TEMPLE PRESS LIMITED

BOWLING GREEN LANE, LONDON, E.C.1

Please write for full list of books published in association with "Plastics."

Are You Buying

B.L.C.
(EXPORTS) LIMITED

92 BAYLIS ROAD
LONDON S.E.1

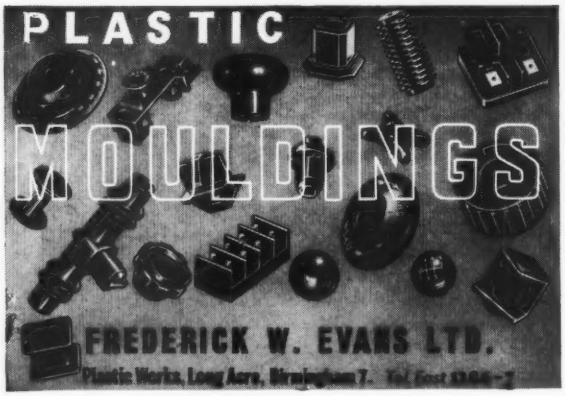
TELEGRAMS / PHONE BALACA WATerloo 3617-7

HOME AND EXPORT

the **RIGHT** *Quality at the* **RIGHT** *Price?*

for **ALL THERMOPLASTICS**

CELLULOSE ACETATE · BUTYRATE
POLYSTYRENE · P.V.C., etc., etc.



DIXONS OF HALIFAX

★ **Wire Shapes**
FOR THE PLASTICS TRADE

ARTHUR DIXON & CO. LTD.
RAGLAN ST., HALIFAX, YORKS
Halifax 3339 & 5249
103 GEORGE STREET, CROYDON
SURREY Croydon 3814

M.C.M.
(TOOLS) LTD.

Designers and Toolmakers
for Compression, Transfer and Injection Moulds, Pressure Die Casting Tools, Jigs and Fixtures
Let us solve your difficulties

M.C.M. (Tools) LTD. 12, Denmark Street, Aston
BIRMINGHAM, 19 *Aston Cross 1878*

TUFFLEX

EXTRUSIONS
are our business . . .
Not just a department

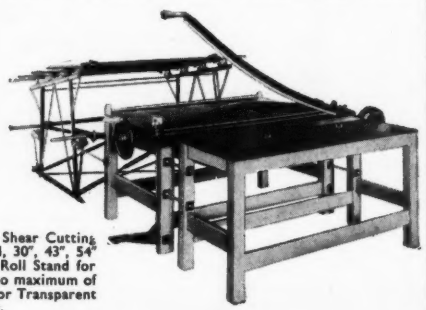
AS the leading specialists in this field our technical staff welcome enquiries for all types of extruded plastics. We can promise you also keen personal service and a completely satisfactory product.

C&C MARSHALL LTD

PLASTRIP HOUSE, OAKLEIGH ROAD NORTH, LONDON, N.20
Telephone : Hillside 5041 (3 lines). Telegrams : Tufflex, Norfinch, London
Cables : Tufflex, London

SHEAR CUTTING MACHINERY *for* Cutting Sheet Plastics and Rubber, etc.

T. KENDELL & SONS LTD.
Established 1840
FRENCH PLACE, LONDON, E.1.



Model No. 1 Hand Shear Cutting Machine, 30", 43", 54" and 60" length of cut.

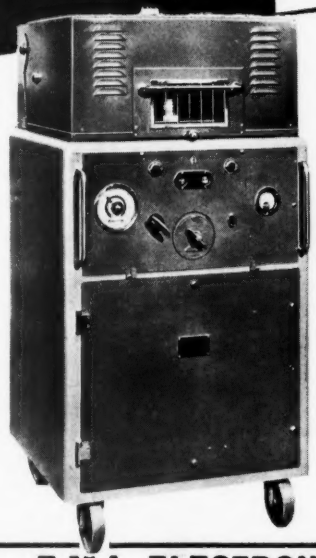
Shear Machines, Bench and Floor Models. From 3" to 114" Length of cut. Many other Machines for Your Trade.

Model No. 1 R.F. Hand Shear Cutting Machine with Roll Stand, 30", 43", 54" and 60" length of cut. Roll Stand for any number of rolls up to maximum of six. Specially suitable for Transparent Film, etc.

E·M·I

HIGH FREQUENCY HEATERS

FOR THE PLASTICS INDUSTRY



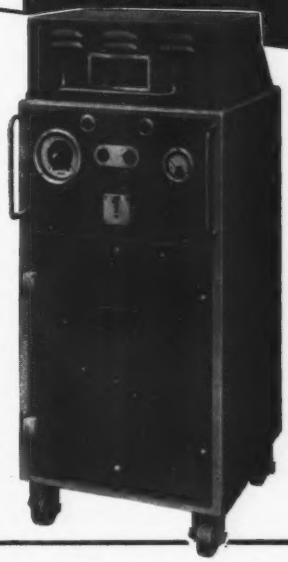
The special features of the E.M.I. Radio Frequency Heaters are:

- ★ Low running and maintenance costs.
- ★ Immediate servicing facilities.
- ★ Simplicity of operation.
- ★ Versatility.
- ★ Robustness.
- ★ Backed by sound technical advisory service.

RFH/1 *(Illustrated right).* 1 Kw. (58 BTU per minute). Oven will handle 2 lbs. powder. Heating rate 12 ozs. G.P. Moulding Powder per minute through 100°C.

DH 35A & B *(Illustrated left).* 3½ Kw. (200 BTU per minute). Oven size 18″ x 18″. Heating rate 2½ lbs. G.P. Moulding Powder per minute through 100°C. Available with either single or dual timer control panel.

For full details of H.F. Heating equipment:-



E.M.I. ELECTRONICS LTD. HAYES, MIDDLESEX. Telephone: SOUTHALL 2468 Ext. 473

Cellulose Acetate Plastics

By Vivian Stannett

THIS IS THE First Book to be entirely devoted to a thorough technical survey of the properties and potentialities of this well-known thermoplastic. It is designed to be of equal interest and value to the business man and the engineer or chemist, and includes a chapter on packaging and container applications.

Illustrated, 30s. net, by post 30s. 8d.

TEMPLE PRESS LIMITED

BOWLING GREEN LANE, LONDON, E.C.1

Please write for full list of books published in association with "Plastics."

DEEGLAS

GLASS FIBRE MAT

for better mouldings

Just as metal tie-rods increase the strength of concrete, so Deeglas Glass Fibre Mat makes possible stronger plastic mouldings. Deeglas can now be supplied pre-impregnated with a range of resins, e.g. Phenolic pre-preg. Deeglas is suitable for moulding either by pressure or vacuum methods and gives a strength and weight ratio nearly double that of aluminium. These pre-preg. methods have already proved their worth in aircraft, boats and cars.

Deeglas is easy to handle and simple to mould. It has an even distribution of fibre. May one of our Technical Representatives call to discuss your own problems which can be solved by the use of Deeglas mat or any of our other products such as Rovings, Chopped Fibre or Cloth.

Deeglas

PUTS **STRENGTH** INTO PLASTICS

For further details, and samples of Rovings, Chopped Fibre and Cloth write to:
GLASS YARNS & DEESIDE FABRICS LTD.
Craven House, 121 Kingsway, London, W.C.2. Tel: Chancery 7343

GD.5

suppliers of the finest reprocessed

Polyethylene

with guaranteed electrical properties

POLYTHENE LTD., 100 Jermyn St., London, S.W.1
Tel.: WHitehall 3978
Grams: Lebathene, Piccy Cables: Lebathene London

W. B. COLDWELL & SONS LTD.

DIESINKERS,
MOULDS,
JIGS.

89-91, ROCKINGHAM LANE,
SHEFFIELD, 1.
TELEPHONE: SHEFFIELD 24047.

THE PICKSTONE
10-SPEED STIRRER UNIT

£3

Maximum Speed 2,700 *r.p.m.*
Maximum Torque 140 *gm. cm.*
Sparkless Induction Motor

Especially designed to lighten labour and expedite experiments in the laboratory

At the low price of £3 this handy Stirrer Unit is proving its worth in laboratories all over the kingdom. Power consumption only 40 watts. Starting torque 80 gm. cm. Controller-switch with 'off' position and 10 speeds. Windings designed for hot running; motor can be stalled at full current indefinitely. Bearings of oil-impregnated porous bronze. Heavily cadmium-plated. 10" steel stalk. Swivel-head for motor locked in desired position with thumb-screw.

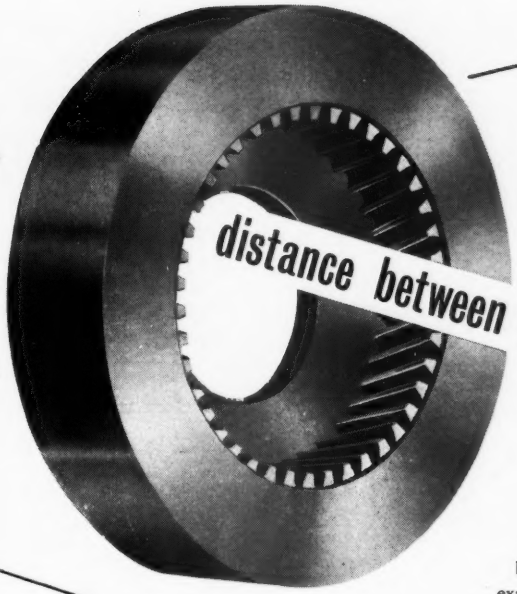
Price includes postage and packing in U.K.

Stainless Steel Stirring Rods are also available. Details on request.

R. E. PICKSTONE LTD.
58-60 ISLINGTON PARK STREET, LONDON, N.1 *CANonbury* 6190

The shortest distance between prototype and product

HARD NICKEL ELECTRO-FORMED DIES



For gear wheels and other industrial components moulded in nylon, the extreme difficulty of estimating shrinkage makes it necessary to use a die which can be corrected *before* a lot of expensive work has been undertaken. Hard nickel electro-formed dies provide the answers to the toolmaker's problems. Made in one piece, without heat treatment, from a master cut to close tolerance and with shrinkage allowance, the electro-formed cavity is first given a trial run by the manufacturer. Thus the die is made exactly to requirements—ready to withstand the longest production run—and saving often 30% to 100% on cost of dies by other methods.

All intricate cavities for injection moulds are 'natural' uses for electro-formed dies. Please write for literature.

LONDON & SCANDINAVIAN METALLURGICAL CO LIMITED

CHELTON WORKS, GONSALVA ROAD, WANDSWORTH, LONDON, S.W.8.

MACaulay 5575 (5 lines)

Moulds for Plastics

By W. M. Halliday 259 pp. Price 30/- (*by post* 30s. 6d.)

An aid to toolmakers in the plastics and pressure diecasting industries dealing with mould design, construction and maintenance.

"An important and comprehensive handbook for plastic-mould engineers and to all those connected with manufacturing plastics products."—MODERN PLASTICS

TEMPLE PRESS LIMITED

BOWLING GREEN LANE, LONDON, E.C.1

M. CALDERON LTD.

SPECIALISTS IN

THE MANUFACTURE OF

HEATING ELEMENTS

FOR THE

PLASTICS MOULDING INDUSTRY

ALL ENQUIRIES TO HEAD OFFICE

SEBASTIAN HOUSE,

SEBASTIAN STREET, LONDON, E.C.1

CLE 1712/3

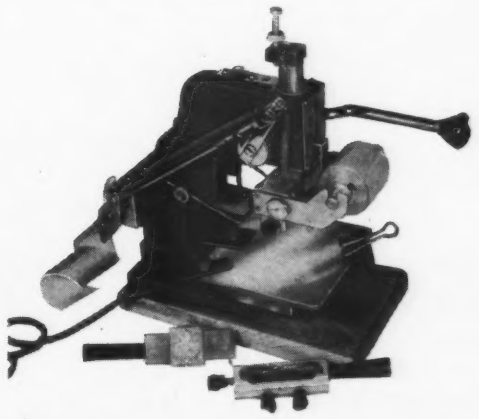
The Amazing **"Giftmark"** EMBOSSING MACHINE

will mark, goldblock, emboss or print

Figural Designs, Texts, Figures, Trade Marks on

LEATHER	LEATHER CLOTH	SILK, COTTON	P.V.C.
CARDBOARD	TEXTILES	PLASTICS	FIBRE, CORK
NYLON	PAPER	ASBESTOS	WOOD
FOUNTAIN PENS		PENCILS	TOYS

and many others swiftly and at little cost



Please forward your samples for a free test imprint to

PRINTAC LTD., Lewis St., CARDIFF

Telephone : Cardiff 27441 Telegrams : Printac

Engraved Rollers for Printing and Embossing

T. G. MARTIN & CO. OLD COLONY HOUSE, 3, RIDGEFIELD, MANCHESTER 2.

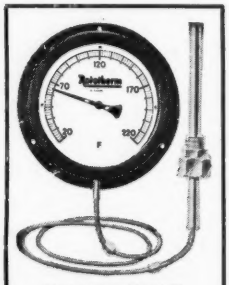
SINGLE-STOREY
WAREHOUSE REQUIRED
IN NORTH OR NORTH-WEST LONDON
FOR HEATING ENGINEERS
A building of 20,000 square feet upwards with good access and loading facilities
CHAMBERLAIN & WILLOWS
23 MOORGATE LONDON E.C.2
City 6013 (8 lines)

PLASTIC SCRAP
Michael S. Stevens
Buyers at Your Works of Injection Scrap, Scrap Cuttings
KESWICK ROAD, LONDON, S.W.15
VANdyke 3345-6

BYSON FOR BAKELITE
Acetate and other Synthetic Mouldings, Modern Plant and Facilities.
APPLIANCE CO. LTD.,
WOOLFOLD, BURY, LANCS.
Telephone: Bury 1560-1 Telegrams: "Bysonite, Bury."

JOHN CASTLE & Co. Ltd.
STOCKISTS of Perspex Sheets, Virgin and Reground Cellulose Acetate, Polythene and Polystyrene Moulding Powders.
POLYTHENE, Polystyrene, Acetate and Perspex. We are sellers and buyers of these materials in any form.
GRANULATION and reprocessing plant available for:— Nylon, Cellulose Acetate, Polystyrene, Polythene and other Thermoplastic scrap. Materials ground to customers' requirements.
All enquiries to :—
JOHN CASTLE & Co. Ltd.
5 HURLEY ROAD, LONDON, S.E.11
Telephone : RELiance 4274/5

to indicate, record or control temperature
Rototherm
BI-METAL · MERCURY-IN-STEEL · VAPOUR PRESSURE
THE BRITISH ROTOTHERM CO. LTD.
Merton Abbey, London, S.W.19.



MERCURY-IN-STEEL DISTANT READING THERMOMETER
Phone: LIBerty 7661

TRADE EMPIRITE MARK
Empire Plastics (BIRMINGHAM) Ltd
EMPIRE WORKS
BRUETON STREET
BIRMINGHAM · 4
Phone: ASTon Cross 2451
PLASTIC MOULDINGS FOR THE TRADE

PIONEERS
IN
MOULDS
for MODERN PLASTICS
also
PRESS TOOLS, JIGS & GAUGES
BARBER & DUFFY LTD.
214/222 CARDIGAN ROAD · LEEDS
Phone : Leeds 52033

Classified Advertisements

PRESS DAY.—Classified advertisements for the April issue must be received at Head Office by first post Tuesday, March 29th. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES.—4d. per word (minimum 12 words 4/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting 35/- per single column inch. Series discounts of 5% for 6, and 10% for 12 consecutive insertions allowed to trade advertisers.

TERMS.—Strictly net and prepayable. Monthly accounts or settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES.—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors although every care is taken to avoid mistakes.

BOX NUMBERS.—Private advertisers desiring to have replies sent care of "Plastics" may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box P000, care of "Plastics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM facilities are available to readers to purchase advertised goods through "Plastics." Commission 1% (minimum 2/-) on amount deposited.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, Phone, London."

BRANCH OFFICES: 7 John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50 Hertford Street, Coventry. Telephone: Coventry 62464. 1 Brazennose Street, Manchester. Telephone: Blackfriars 5038-9. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AUCTIONS

ESTABLISHED 1855.
EDWARD RUSHTON, SON AND KENYON,
INDUSTRIAL VALUERS, AUCTIONEERS AND
FIRE LOSS ASSESSORS,
12 YORK STREET,
MANCHESTER, 2.
Phone, Central 1937-8.
Grams, Russonken, Manchester.
zzz-486

BUSINESS OPPORTUNITIES

DESIGNER OF APPLIANCE with considerable potential sales value toilet goods trade (patent applied for), desires contact plastics manufacturer. Box P1214, care of "Plastics." 212-25

PROGRESSIVE COMPANY marketing plastic goods, offers services to manufacturers as sole distributors. All offers to Acro Marketing, Ltd., 9 Warwick Court, W.C.1. 216-12

VACUUM-FORMING CAPACITY available together with full facilities for fabricating engraving and printing of all plastic materials. Omega Plastics, Ltd., Highbridge Rd., Town Quay, Barking, Essex. 216-13

BUSINESSES, PREMISES, OFFICES, ETC.

IDEAL FOR PLASTIC MOULD OR TOOL MAKERS. Modern factory premises within 16 miles of London, covered area 2,200 sq. ft., mainly clear space, central heating, office accommodation, all services, to be let on lease, rent £700 per annum exclusive. Further details Dudley W. Harris and Co., High St., Feltham. Phone 2000. 212-11

MACHINERY, TOOLS AND PLANT

HYDRAULIC. Frazer Mono-radial pumps, new and second-hand in stock. Thompson and Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-483

NEW HOOVER ¼ H.P. 200-240 V. A.C.S./PH. 50C MOTORS, 1,425 r.p.m. capacitator type double ended shafts, £7 5s. Universal Electrical, 217-221 City Rd., London, E.C.1. 212-1091

MODERN MOULDING PLANT
COMPRISING
THREE 120-TON BRADLEY AND TURTON SEMI-AUTOMATIC PRESSES, ELECTRIC PLATENS.
TWO 25-TON BRADLEY AND TURTON PRESSES WITH ELECTRIC PLATENS.
BRADLEY AND TURTON TWO-STAGE MOTOR DRIVEN PUMPING UNIT.
BRADLEY AND TURTON P.2. PELLETING MACHINE.
THREE 50-TON BRADLEY AND TURTON UPSTROKE MOULDING PRESSES.
Complete unit in excellent condition.
Box P122, care of "Plastics." 212-6

ALTERATIONS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock, keen prices. Contact G. L. Murphy, Ltd., Manston, near Leeds. zzz-489

ELECTRONIC WELDER. Redifon J.P.1. with electrodes practically unused. Box P1217, care of "Plastics." 212-27

STOCK DELIVERY. Four-cylinder hydraulic pumps, 4 g.p.m., 1 ton pressure, £30, or motorized 3-phase, £70. John Steel, Castlefields, Bingley. zzz-495

Machinery, Tools and Plant (contd.)

FOR SALE. Three small injection machines, two hand-operated, one air-operated, latter complete with motor, compressor and storage cylinder. All seen working. Offers wanted. Box P1215, care of "Plastics." 212-24

SEEING IS BELIEVING!!! Make a point to see our new powerful motorized dust, fume extractor-blower units at new low price (£23). Everyone doing so, is most impressed. Bellangers, 306 Holloway Rd., London, N.7. North 4117. 216-1119

HYDRAULIC PRESSES

400-ton Downstroke by Greenwood and Batley. 16-in. dia. main ram by 28-in. stroke. Four cols. 20½ in. by 17¾ in. between. 36 in. by 17½ in. table. Daylight 41 in. W.P. 2 ton sq. in.

250-ton Upstroke by Henry Berry. 15-in. dia. Fescolised ram by 20-in. stroke. Four cols. 23½ in. by 11½ in. between. Table 23½ in. by 22 in. Daylight 20 in. W.P. 1½ ton sq. in.

200-ton Upstroke by Hydraulic Eng. D/A piston-type ram 10-in./10½-in. dia. by 20-in. stroke. Four cols. 25 in. by 15 in. between. Table 31 in. by 25 in. Daylight 12½ in. W.P. 2½ tons sq. in. With electric platens and Towler pumping equipment.

160-ton Self-contained Downstroke by E.M.B. Fabricated frame. Fitted electric platens 24 in. by 19 in. Daylight 16 in. Bottom hydraulic ejector or transfer ram 5½-in. dia. by 6½-in. stroke. Arranged for automatic prefilling with Towler "Electraulic" pump, safety guards, etc.

100-ton Downstroke by Bradley and Turton. 12-in. dia. ram by 10-in. stroke. Four cols. 21½ in. by 11 in. between. Table area 21½ in. by 21 in. Daylight 21 in. Arranged for semi-automatic prefilling. W.P. 1 ton sq. in.

100-ton Downstroke by Finney. 12-in. dia. ram by 20-in. stroke. Four cols, 30½ in. by 14½ in. between. Tee-slotted table 2-ft. sq. Daylight 32 in. Arranged for automatic prefilling with bottom ejected. W.P. 1 ton sq. in.

80-ton Downstroke by Finney. 10½-in. dia. ram by 18-in. stroke. Four cols. 21 in. by 10 in. between. Tee-slotted table 18 in. sq. Daylight 30 in. Arranged for automatic prefilling with bottom ejector. W.P. 1 ton sq. in.

65-ton Upstroke by Rice. 9-in. dia. ram by 10-in. stroke. Four cols. 13 in. by 13 in. between. Table 21 in. by 13 in. Daylight adjustable 22 in. to 18 in. W.P. 1 ton sq. in.

50-ton Upstroke Laboratory by Finney. 5-in. dia. ram by 8-in. stroke. Four cols. 15 in. by 10 in. between. Table 16 in. by 15 in. Head screwed down by means of screw and handwheel giving adjustable daylight 9½ in. to 21 in. Complete with Venning high-speed pump and 14-in. sq. platens.

50-ton Downstroke "Coborn," 8-in. dia. ram by 14-in. stroke. Four cols. 15 in. by 9 in. between. Table 17 in. by 15 in. Fitted with 17½ in. by 14½ in. electric platens, with thermostats. Daylight 17½ in. Included are hydraulic ejector, prefil tank, valve, Towler "Electraulic" pumping equipment, control gear, etc.

GEORGE COHEN, SONS, AND CO., LTD.,
WOOD LANE,
LONDON, W.12.
Phone, Shepherds Bush 2070
and
STANNINGLEY, NEAR LEEDS.
Phone, Pudsey 2241. 212-10

Machinery, Tools and Plant (contd.)

THREE WESTMINSTER, HAND-OPERATED, INJECTION MOULDING MACHINES up to 10 gr. and one Hupfield Granulating machine for disposal Inquire Box P127, care of "Plastics." 212-18

PLASTICS MACHINERY.
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.
Send your inquiries to the specialists,
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET, MILLWALL, E.14.
Phone, East 4081 (five lines). 212-2

NEW HIGH-SPEED ELECTRIC BANDSAWS for sale, for cutting polythene, P.V.C., rubber, Perspex, cork, leather, cloth, etc. Stainless steel or wood table. Three sizes: 24 in., 30 in., 36 in. Max. height of cut on 36-in. machines 19 in., 400/440/3 phase supply. Illustrations and prices from makers, F. J. Edwards, Ltd., 359 Euston Rd., London, N.W.1. Eus 4681. 212-37

MACHINERY, TOOLS AND PLANT WANTED

COMPRESSION AND INJECTION MOULDING TOOLS WANTED. Send details of your surplus, obsolete and redundant moulding tools. Box P0720, care of "Plastics." 212-1082

INJECTION MOULDING MACHINES required. Condition or size not important. Send details. Box P0814, care of "Plastics." 213-1090

HYDRAULIC PRESS 500-2,000-ton wanted, stroke and condition not important. Box P1221, care of "Plastics." 212-33

INJECTION MOULDING MACHINE 16-32 oz. required for export, condition or speed not important ("home made" or old machine). Box P1220, care of "Plastics." 212-32

150-TON DOWNSTROKE PRESS, complete with pump and fittings. Box P114, care of "Plastics." 212-x7876

URGENTLY REQUIRED, one or two Francis Shaw hand-operated injection moulding machines (capacity ⅜-oz.). Box P1212, care of "Plastics." 212-20

MISCELLANEOUS

EXTEND YOUR TRADE.
Use a trade mark. Consult
Trade Mark Protection Society,
12 Church St., Liverpool. zzz-478

MOULDS

MOULDS FOR DISPOSAL. In excellent condition. For various popular fancy lines. Home and Export inquiries invited. Details, prices and samples in application. Box P1137, care of "Plastics." 212-35

MOULDS WANTED

WE ARE INTERESTED in buying second-hand moulds for 3-oz.-8-oz. injection moulding machines; also extruding machine in good condition. Box P1128, care of "Plastics." 212-1107

SECOND-HAND MOULDS for polythene kitchenware, etc., for 8-oz./30-oz. injection moulding machine wanted for export. Box P1222, care of "Plastics." 212-34

Moulds Wanted (contd.)

REQUIRED. Good second-hand plastic moulds to suit " Peco " 2-oz. machine. Box P1131, care of " Plastics." 212-36

WANTED for hire or purchase, injection mould for miniature comb, eyelash, doll or pocket variety, not exceeding 3 in. in length. Hornflowa, Ltd., Maryport, Cumb. 212-5

PATENTS

PATENT APPLICANT PLASTIC INJECTION MACHINE. Would demonstrate prototype to interested manufacturers, by appointment. Box P1219, care of " Plastics." 214-1122

PRODUCTION CAPACITY

INJECTION MOULDINGS AND PLASTIC COVERINGS in acetate alkathene, p.v.c. machine parts in brass, steel and plastics.

We now have extra capacity and can offer quick delivery at our new factory. We solicit your inquiries. F. A. Ketch and Son, Ltd., Trent Valley Works, Lichfield, Staffs. Lichfield 3052. zzz-476

KINGSTON PLASTICS, LTD., Unity Works, Union St., Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding, incorporating magnetic separation of metallic particles of all thermoplastics undertaken. Phone, Kingston 8405. 213-1084

CHIPPING OF PLASTICS AND GRINDING, screening, mixing and drying of all raw materials undertaken for the trade. Crack Pulverizing Mills, Ltd., Plantation House, London, E.C.3. Man 4405. zzz-487

INJECTION MOULDINGS IN THERMOPLASTICS. Moulding in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtenay, Ltd., 138 Stratford Rd., Birmingham, 11. 214-1093

VISIJAR LABORATORIES, LTD.,
THE LEADING CRAFTSMEN IN
" PERSPEX "
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS " PERSPEX "
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF " FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines). zzz-492

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 220-1094

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and Central 1000. zzz-493

ELCO PLASTICS, LTD.,
High Wycombe, Bucks. Phone 1921-2.
Over 50 presses.
Experienced compression, transfer and injection moulders.
Designers and makers of moulds on the premises.
Large assembly shops.
Capacity up to 500-ton compression and 10-oz. injection.
A.I.D. approved. zzz-496

TUBE LAMINATION ENGINEERING, LTD.,
High Wycombe, Bucks. Phone 1921-2.
Makers of synthetic resin-bonded tubes.
Round.
Square.
Rectangular.
Fabricators and assemblers in plastics and metals. Full supporting machine shop available. zzz-497

IF YOU NEED
IMMEDIATE AND INEXPENSIVE
INJECTION MOULDING CAPACITY
FROM 2 TO 32 OZS.
(BUT ESPECIALLY 8 OZ.)
CONTACT US WITHOUT DELAY.
AT BOX P0513,
CARE OF " PLASTICS." 212-4

Production Capacity (contd.)

VACUUM MOULDERS invite trade inquiries for vacuum-formed articles, moulded in p.v.c. styrene, cellulose acetate, etc. Maximum mould size 36 in. by 36 in. Write Box P098, care of " Plastics." 217-1112

PULVERIZING, grinding and chipping to the trade. L. Lipton, Ltd., Lamprell St., Bow, E.3. Adv 3345. 214-1113

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. Phone 4059. 223-1118

DINES PRODUCTS, Whitehall Lane, Grays, Essex, for injection mouldings. 223-11..

SHORT RUNS A SPECIALITY: LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorn 7927. 223-1121

RAW MATERIAL

PERSPEX! PERSPEX!! PERSPEX!!! Official stockists for I.C.I. acrylic sheets. Sheets cut to your requirements. Fabrication and mounting specialists to the trade:—
S. C. Errington (Hanwell), Ltd., 132a Uxbridge Rd., Hanwell, London, W.7. Phone, Ealing 5288. zzz-40

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS,
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. 221-1103

FOR HOME AND EXPORT MARKET. We sell at low prices all plastic scraps, Acetate, Polystyrene, Alkathene, reground powders and reconditioned powders. Apply to Box P009, care of " Plastics." 212-28

PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, TUBE.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and 1000. zzz-494

BLACK CELLULOSE ACETATE MOULDING POWDER. We can always supply first-grade at 2s. per lb., any quantity. Box P008, care of " Plastics." 212-29

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 270 Corporation St., Birmingham. Central 5474. 212-1

POLYTHENE AND POLYSTYRENE, mixed and sorted to colours, reground, for sale. Write for particulars, Box P124, care of " Plastics." 212-16

POLYSTYRENE, new material, crystal clear at favourable price available. Box P121, care of " Plastics " 212-15

CELLULOSE ACETATE BARGAIN!! Virgin interleaved material in manufacturers original unopened cases, 20 in. by 30 in. by 1 mm. matt/pol., 1,500 sheets available, weighs 1 lb 3 oz. per sheet, approximately 40% saving on list, 5s. 6d. per lb. Any quantity supplied. 250 only, sheets, smoke grey, 54 in. by 24 in. by 15 thou., perfect condition interleaved, 5s. per lb. Victor Laurence (Merchants), Ltd., 62-64 Hampstead Rd., N.W.1. Euston 6134-5. 212-9

RAW MATERIAL WANTED

WANTED, Polythene scrap. Write to Box P7416, care of " Plastics." zzz-0322

SURPLUS STOCKS of thermosetting and thermoplastic moulding powders wanted. Send details Box P056, care of " Plastics." zzz-481

ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured, highest prices paid. 217-1079

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24. zzz-490

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and packing. Box P873, care of " Plastics." zzz-491

Raw Material Wanted (contd.)

POLYSTYRENE AND POLYTHENE, any quantities or virgin material, scrap nozzle lumps, urgently wanted. Please offer with samples to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 212-17

SCRAP.
WE BUY
ALL THERMO-PLASTICS. REJECTED MOULDED PIECES. OBSOLETE MOULDING POWDERS. LUMPS, SPRUES AND RUNNERS.
AND PAY HIGHEST PRICES.
J. W. NASH AND CO., LTD.,
27 BEETHOVEN STREET, W.10.
Ladbroke 4655. 212-30

RAW MATERIALS wanted. Polystyrene, polythene, C.A., P.V.C., Diakon, reject moulds, sprues, runners, lumps, etc. Highest price paid. Prompt payment. Also spot lot origin. Box P1020, care of " Plastics." 212-1106

SITUATIONS VACANT

The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency, if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

ASSISTANT CHEMIST wanted for the thermoplastic floor tile factory of the Marley Floor Tile Co., S.A. (Pty.), Ltd., at Nigel, near Johannesburg, South Africa. Permanent position with excellent prospects. Good climate. Training given in England prior to taking up South African post. Degree not essential. Good salary. Housing availability in the district good.
Apply to Technical Director, Marley Tile Co., Ltd., London Rd., Riverhead, Sevenoaks, Kent. 213-1115

PLASTICS CHEMIST
A chemist, specializing in the vinyl plastics field, is required for a position of exceptional interest with excellent prospects in a new technical service laboratory in the North West, duties will include the testing of vinyl compounding ingredients and the formulation of all types of vinyl compound. Practical experience will be given greater consideration than academic qualification, but A.R.I.C. or Ordinary degree standard is desirable.
The successful applicant will take charge of one of a small group of laboratories, and should be aged between 25 and 35. Salary will be in accordance with qualifications and experience. Box P1210, care of " Plastics." 213-1116

JUNIOR TECHNICAL SERVICE REPRESENTATIVE.
A vacancy arises for a junior technical representative to assist in the sales and technical service of a range of speciality products for the vinyl plastics industry.
Applications will be welcomed from men of 20 to 30 years of age, having a H.N.C. or Inter B.Sc. in chemistry and interested in pursuing a commercial career in a highly technical field.
Applicants must hold a driving licence, salary will be in accordance with qualifications and experience. The successful applicant will be based at Liverpool. Box P129, care of " Plastics." 213-1117

LABORATORY TECHNICIAN AND CHEMIST required by manufacturers of compounding and extruding machines to take charge of new service laboratory in Herts.
Applicant should be conversant with processing vinyl plastics, etc., some engineering knowledge an advantage, would consider services as consultant or part-time. Write in confidence to Box P1216, care of " Plastics." 212-26

QUALIFIED SALES REPRESENTATIVE required to sell technical products. Age 27-35. Good personality essential. Sound engineering background and practical experience in either the structural, marine or aeronautical fields desirable.
Write, stating professional qualifications, to Box P1218, care of " Plastics." 212-31

TECHNICAL SALES REPRESENTATIVE required by company engaged in the fabrication of a wide range of plastic materials.
Applicant must have knowledge of the application of Plastics and experience in selling. Apply in confidence Managing Director, giving experience and salary required, to Box P1223, care of " Plastics." 212-x8434

DESIGNER/DRAUGHTSMAN required for compression, transfer and injection moulding firm, Cheshire district, only fully competent men need apply.
Write, stating age, experience and salary required to: Box P126, care of " Plastics." 212-14

MANUFACTURERS of compounder and extruding machines require technical sales engineer to operate from London. Applicants must have technical experience processing P.V.C. and other types of material. Please write in confidence stating qualifications and salary required. Box P125, care of " Plastics." 212-13

Situations Vacant (contd.)

RESIN CHEMIST. Young man B.Sc. or equivalent with some experience in development of thermosetting resins required for research department of Plastics Co. in Central London. Wide scope in an expanding organization. Salary dependent on qualifications, but not less than £700 p.a. Please write in fullest confidence to GA. Box P123, care of "Plastics." 212-12

SALES ENGINEERS (PLASTICS) required Midlands and Northern area with established connections principally motor car and rolling stock industries; Scotland principally shipbuilding industry; London area principally ministries. Compression moulding capacity up to 250 tons, injection moulding capacity up to 8 oz., extrusion and bottle blowing. Salary £600 per annum plus 2½ commission which should result in no less than £2,000 per annum. Full curriculum vitae to Sales Manager, Lacrinoid Products, Ltd., Gidea Park, Essex. 212-8

TECHNICAL SERVICE REPRESENTATIVE.
A vacancy exists for a chemist, A.R.I.C. or graduate standard, to act as Technical Representative for a Lancashire company producing a rapidly expanding range of speciality chemicals for vinyl plastics processing; commercial experience preferred but not essential. A car is provided, and salary will be in accordance with qualifications and experience. Box P128, care of "Plastics." 213-1111

CONTROL LABORATORY SUPERINTENDENT required for works of Marley Tile Co., Ltd., Harrietsham, near Maidstone, Kent. Should be familiar with control of formulation and testing of finished products. Previous experience essential. Works situated in delightful rural surroundings. Favourable pension scheme. Canteen. Housing provided if required. Write giving age, details of experience and salary to Factory Manager. 213-1114

TWO YOUNG MEN, aged 24-28, required as trainee factory managers and assistant factory managers. Applicants should have experience in plastic, thermoplastic or rubber industry and/or engineering background. Apply to Manufacturing Department, The Marley Floor Tile Co., Ltd., Riverhead, Sevenoaks, Kent. 212-38

SETTERS required by company engaged in injection moulding of thermoplastic materials. Experience preferred. Canteen and social club facilities. Please apply Injection Moulders, Ltd., Westmoreland Rd., N.W.9. Col 8868. 212-x8540

A VACANCY EXISTS in the tool drawing office of Ashdowns, Ltd., St. Helens, for a jig and tool draughtsman aged, not less than, 26 years. It is desirable that he should have a Higher National Certificate and preferably have had some experience of plastic mould design. Duties will include the design and detail drawing of moulds for the production of plastic mouldings by compression, injection, and transfer methods.

Applications should be made to The Secretary, Ashdowns, Ltd., Eccleston, St. Helens, Lancashire. 212-3

WELL QUALIFIED GRADUATE CHEMIST OR PHYSICIST, preferably with experience in the Plastics industry, wanted for development work in the rapidly expanding field of Fibreglass Reinforced Plastics; salary according to age and experience with good conditions of employment and promotion prospects.

Applications to the Technical Director, Fibreglass, Ltd., Ravenhead Works, St. Helens, Lancashire (a subsidiary of Pilkington Brothers, Ltd.). 212-22

Situations Vacant (contd.)

MINISTRY OF SUPPLY require physical chemist and/or physicists for the following posts at Royal Aircraft Establishment, Farnborough, Hants. (1) Physicist with good background in mathematics to work on properties of materials with particular reference to aircraft. Candidates should have an interest in physical and mechanical testing, in development of suitable test methods, and in properties of materials generally. (2) Physicist or physical chemist with an interest in properties of materials for work on development of fibre in reinforced products with particular reference to use in aircraft. A knowledge of plastics industry would be an asset. Qualifications: Higher School Certificate (Science) or equivalent. Some interest in engineering may be an advantage. Appointments as Assistant Experimental Officer with salary range £288 10s. (age 18)—£640. Women somewhat less. Possibilities of promotion to higher grades. Not established, but opportunities to compete, for establishment may arise. Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King St., London, S.W.1, quoting A51/5A. Closing date March 29 ,1955. 212-7

YOUNG TECHNICAL EXECUTIVE with preferably a chemical background required by synthetic resin adhesive manufacturers to direct and develop field technical service in existing and new outlets. Knowledge of woodworking techniques an advantage, but ability to assimilate industrial processes more important. This position, which is a senior one, offers an interesting career with good prospects and calls for a strong personality and imaginative thinking.

Applicants must be prepared to travel mainly in the U.K. and for preference should be between 25 and 35. Salary according to qualifications and experience.

Apply in writing giving details of age and experience to Box P1211 care of "Plastics." 212-19

CHEMISTS ARE REQUIRED for the Plastics Division of Thomas De La Rue and Co., Ltd. The vacancies are caused by the continuous expansion of the company's activities in the plastics field and offer a wide experience in this industry.

Applicants should possess a University degree, High National Certificate, or A.R.I.C. in Chemistry or Technology and must show evidence of a wide field of interests. The positions may involve liaison with customers and a pleasant personality will therefore be considered important.

Successful applicants will be given adequate training and will then be responsible for Process Control of Plastics manufacture. Promotion will be rapid for those showing keenness and ability.

The starting salary will depend upon qualifications and experience but will in no case be less than £600 p.a. Apply giving brief details of academic and industrial experience to Personel Manager, Thomas De La Rue and Co., Ltd., West Chirton, North Shields, Northumberland. 212-21

SENIOR RESEARCH CHEMIST is required by Imperial Smelting Corporation, Ltd., to carry out investigations into the preparation of fluorine containing polymers and the determination of properties of the polymers. Applicants should preferably have had relevant experience of polymer of fluorine research work and possess an Honours or Post-Graduate degree, although applications will be entertained from persons less qualified but with relevant experience.

Applications to Personnel Manager, Imperial Smelting Corporation, Ltd., St. Andrew's Rd., Avonmouth, near Bristol, quoting reference ORG/P. 212-23

Situations Vacant (contd.)

LABORATORY TECHNICIAN.
A position of exceptional interest, with excellent prospects, is available to a man between 23 and 40 years of age with practical experience of the vinyl plastics industry to take charge of pilot plant work (extrusion, calendering, moulding, spreading and dipping), in a new technical service laboratory in the North-West. Practical knowledge of these processes, or the majority of them, is essential, some engineering training would be of advantage, chemical knowledge is not required. Salary will be in accordance with qualifications and experience. Box P1213, care of "Plastics." 213-1109

P.V.C. CHEMIST/TECHNOLOGIST required for production control and development. Some experience of the coated fabrics industry would be an advantage but is not essential. Applications stating qualifications and salary required will be treated in confidence and should be addressed to, The Managing Director, Bernard Wardle (Everflex), Ltd., Peblic Mill, Caernarvon. 213-1110

SITUATIONS WANTED

AGENT, first-class connections with wholesale and retail traders in Ireland for toys, light hardware, fancy goods and novelties. Open to act for firms wishing representation or re-distribution here. Maurice G. Quinlan, 24 South Frederick St., Dublin, Ireland. 212-x8175

TIME RECORDERS

FACTORY TIME RECORDER. Service rental. Phone, Hop 2230. Time Recorder Supply and Maintenance Co., Ltd., 157-158 Borough High St., S.E.1. 221-1102

TUITION

NORTHAMPTON POLYTECHNIC, LONDON, E.C.1.
SUMMER SCHOOL
IN
INSTRUMENTATION
AND
AUTOMATIC PROCESS CONTROL.

An intensive course (of lectures and practical work) on Instrumentation and Automatic Process Control will be conducted from June 27 to July 22, 1955.

Applicants should hold H.N.C. or B.Sc. or equivalent qualification, but no previous knowledge of Instrumentation or Automatic Control will be assumed.

Further particulars and syllabus may be obtained from the Responsible Lecturer, Department of Instrument Engineering. 212-39

BOOKS AND PUBLICATIONS

THE THEORY OF POLYMERIZATION, by H. R. Fleck, M.Sc., F.R.I.C. Full examination in simple language with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated, 144 pages, 10s. 6d. net from booksellers, or 11s. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

PLASTICS, SCIENTIFIC AND TECHNOLOGICAL (3rd edition), by H. R. Fleck, M.Sc., F.R.I.C. A completely revised edition of a recognized standard work on the chemistry and technology of plastics. ". . . should be in every technical library."—Times Review of Industry. Illustrated, 400 pages, 40s. net from booksellers, or 40s. 9d. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

EDITORIAL AND BUSINESS NOTICES

"PLASTICS" is published on the second Wednesday in each month in London, England, by TEMPLE PRESS LIMITED, and is registered for transmission to Canada and Newfoundland by magazine post.

ADVERTISEMENT AND PUBLISHING OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, Phone, London."

EDITORIAL OFFICES.—27, Shaftesbury Avenue, London, W.1. Telephone: Gerrard 4406.

BRANCH OFFICES.—7, John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester, 2. Telephone: Blackfriars 5038-9. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

EDITORIAL.—All editorial communications and matter must be addressed to the Editor and not to individuals. Drawings or MSS or other material not considered suitable will be returned if stamps are enclosed, but the Editor does not hold himself responsible for the safe keeping or safe return of anything submitted for his consideration. Payment for contributions will be made during the month following publication.

ADVERTISEMENTS.—Whilst every precaution is taken to ensure accurate printing, the publishers will not be responsible for printers' errors, or for errors arising out of telephonic instructions relating to advertisement copy, nor can they accept responsibility for the loss of or damage to advertisers' blocks left in their custody. Copy must be supplied without application from the publishers, and current copy and blocks will be repeated if new copy is not received at the time of closing for press. Orders for advertisements are subject to acceptance in writing from the Head Offices. Advertisement copy is subject to the approval of the publishers. All advertisements and contracts are accepted and made upon the express condition that the publishers have the absolute right to refuse to insert copy to which they may object for legal, public or trade reasons, which includes the right of rejection of advertisements, whole or part, containing cut prices of goods coming under an approved price-maintenance scheme, and such refusal of copy shall not be a good ground for advertisers to stop a current contract or to refuse to pay for the same, or for taking action for breach of contract. The publishers, whilst endeavouring to ensure that advertisements shall appear with all possible regularity, will not be held liable for any loss occasioned by the failure of any advertisements to appear from any cause whatever. The acceptance of an order does not confer the right to renew upon similar terms. Contracts relate to the advertisers' own goods or services, and the space may not be sub-let or disposed of in any way. Conditions which are contained in order forms other than those of the Proprietors and which do not conform to, or are in addition to, the Proprietors' conditions, will not be recognized as binding. Special conditions must be subject to mutual agreement.

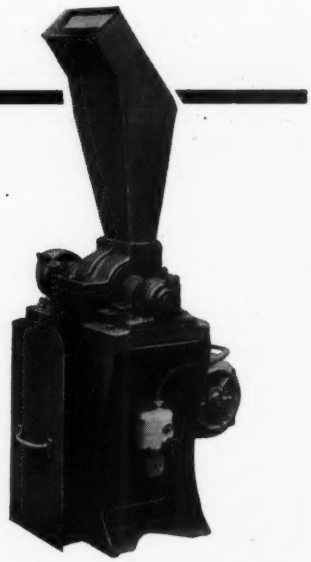
SUBSCRIPTIONS AND SUPPLIES.—"Plastics" is obtainable to order from newsagents and bookstalls or by post from the publishers at an annual subscription rate of 34/- (Canada and U.S.A. $5.50), postage included. Shorter periods pro rata. Subscriptions are prepayable.

"Plastics" is obtainable from newsagents and bookstalls abroad through the following agents:—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette et Cie, Paris; W. H. Smith & Son, Paris and Brussels. U.S.A.—International News Co., New York. Canada—Wm. Dawson, Subscription Service Ltd., Toronto, etc.; Gordon & Gotch, Ltd., Toronto. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch(A'sia), Ltd.

REMITTANCES.—Postal orders, cheques, etc., should be made payable to TEMPLE PRESS LTD.

COMMUNICATIONS.—All orders, letters and inquiries regarding advertisements, subscriptions, and other business matters should be addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

The JUNIOR ROTARY CUTTER



This is the ideal Rotary Cutter designed to meet all demands, for a really robust yet small machine with a high performance.

The Junior is a product of specialists in Rotary Cutter design over many years, and is an addition to the range of well-known Masson Rotary Cutters.

The Junior Rotary Cutter is a self-contained unit with built-in granule collecting drawer, and is driven by a 1 h.p. motor mounted on framework.

The machine is quiet in operation and has been designed to ensure easy cleaning and maintenance. If desired the unit can be supplied suitable for bench or mobile mounting.

Please write for further details

BLACKFRIARS ROTARY CUTTERS LTD

BLACKFRIARS HOUSE NEW BRIDGE STREET

LONDON E.C.4

TELEPHONE: CENTRAL 6383-4

TELEGRAMS: PAPMILENG LUD LONDON

INDEX TO ADVERTISERS

Name	Page
A	
Arpal (Engineers), Ltd.	68
Ashdowns, Ltd.	10
Asmidar Plastic Moulding Machines, Ltd.	4
Associated Lead Manufacturers, Ltd.	39
B	
Bakelite, Ltd.	Back Cover, 46
Ball, W. W., & Sons, Ltd.	12
Barber & Duffy, Ltd.	78
B.I.P. Chemicals, Ltd.	55
B.I.P. Engineering, Ltd.	49
Birkbys, Ltd.	6
Blackfriars Rotary Cutters, Ltd	82
B.L.C. (Exports), Ltd.	74
Blythe Colour Works, Ltd.	Inside Back Cover
Brand, Ed., Ltd.	66
Bridge, David, & Co., Ltd.	22
Briggs Bros. & Co.	70
British Celanese, Ltd.	57
British Electrical Development Association, The	43
British Ermeto Corp., Ltd.	60
British Geon, Ltd.	13
British Oxygen Co., Ltd., The	15, 38
British Resin Products, Ltd.	3
British Rototherm Co., Ltd., The	78
Bush, Beach & Gent, Ltd.	72
BX Plastics, Ltd.	Front Cover
Byson Appliance Co., Ltd.	78
C	
Calderon, M., Ltd.	77
Canning, W., Ltd.	72
Case Development Co., Ltd.	65
Castle, John & Co., Ltd.	78
Catalin, Ltd.	26
Chamberlain & Willows	78
Cohen, George, Sons & Co., Ltd.	69
Coldwell, W. B., & Sons, Ltd.	76
Cole, R. H., & Co., Ltd.	50
D	
Dixon, Arthur, & Co., Ltd.	74
Dunbar & Cook, Ltd.	66
E	
Ebonestos Industries, Ltd.	54
Elliott, E., Ltd.	44
E.M.I. Factories, Ltd.	75
Empire Plastics (Birmingham), Ltd.	78
Erinoid, Ltd.	Inside Front Cover, 35
Ether, Ltd.	66
Evans, Frederick W., Ltd.	74
Extrudex, Ltd.	58
F	
Ferguson, James & Sons, Ltd.	17, 61
Fibreglass, Ltd.	16
Firth Brown Tools, Ltd.	56
Flextol Engineering Co., Ltd.	73
Forth Chemicals, Ltd.	20
Foster Yates & Thom., Ltd.	21
G	
Geigy Co. Ltd., The	2
General Electric Co., Ltd., The	9
Glass Yarns & Deeside Fabrics, Ltd.	76
Gosheron, John & Co., Ltd.	62
Greenbank Engineering Co., Ltd.	70
H	
Harvey, G. A. & Co. (London), Ltd.	71
Hellermann, Ltd.	63
I	
Iddon Bros., Ltd.	11
Imperial Chemical Industries, Ltd.	18
Imperial Chemical Industries, Ltd.—Billingham Development	23
Industrial Appliances, Ltd.	59
Ioco, Ltd.	64
K	
Kendell & Sons, Ltd.	74
Kent Mouldings	67
Kenure, J. F., Ltd.	69
King, Geo. W., Ltd.	25
Kleestron, Ltd.	36
Kodak, Ltd.	58
L	
Lacrinoid Products, Ltd.	28
London & Scandinavian Metallurgical Co., Ltd.	77
M	
Marshall, C. & C., Ltd.	74
Martin, T. G., & Co.	78
M.C.M Tools, Ltd.	74
Melwood Thermoplastics, Ltd.	63
Mentmore Manufacturing Co., Ltd.	1
Metropolitan Plastics, Ltd.	29
Micanite & Insulators Co., Ltd., The	19
Microcell, Ltd.	61
Mining & Chemical Products, Ltd.	8
Monsanto Chemicals, Ltd.	20, 34
Morton Machine Co., Ltd.	67
N	
National College of Rubber Technology	68
National Plastics (Sales), Ltd.	48
P	
Pickstone, R. E., Ltd.	76
Plastic Engineers, Ltd.	60
Polythene, Ltd.	76
Printac, Ltd.	77
Projectile & Engineering Co., Ltd., The	32
Pure Chemicals, Ltd.	45
R	
Radio Heaters, Ltd.	64
Reliance Trading Co.	72
Resinous Chemicals, Ltd.	53
Rootes Mouldings, Ltd.	30
S	
Simon, Henry, Ltd.	14
Sterling Moulding Materials, Ltd.	33
Stevens, Michael, S.	78
Streetly Manufacturing Co., Ltd., The	51
Styrene Products, Ltd.	35
Surridge's Patents, Ltd.	70
T	
Tant, W. H., & Co., Ltd.	73
Thermo-Plastics, Ltd.	27
Tullis Russell & Co., Ltd.	31
Turner Bros. Asbestos Co., Ltd.	62
U	
United Ebonite & Lorival, Ltd.	52
Universal Metal Products, Ltd.	5
Universal Tools, Ltd.	37
Utilex, Ltd.	72
V	
Vinatex, Ltd.	40
Vulcan Boiler & General Insurance Co., Ltd., The	65
W	
Wallace, H. W., & Co., Ltd.	68
Whiting, L., Ltd.	71
Wiggins, Teape & Alex Pirie (Sales), Ltd.	7
Windsor, R. H., Ltd.	24

Printed in England and Published Monthly by the Proprietors, TEMPLE PRESS LTD., BOWLING GREEN LANE, LONDON, E.C.1.

PLASTICS and COLOUR

Without colour how very limited would be the scope and appeal of plastics. Lamp shades, telephones, spectacle frames, ash trays, paper knives, table cloths, sheetings and a thousand-and-one other things are dependent upon colour for much of their attractiveness. And in many cases upon Blythe Permanent Colours, as permanent as colours can be. Whether they are used as pure colours or as pastel shades of the utmost delicacy, Blythe inorganic pigments are unrivalled for fastness to light, heat and the most arduous conditions.

Wherever colours of utmost permanence are required, our specialised experience as manufacturers of the world's best colours is always available.

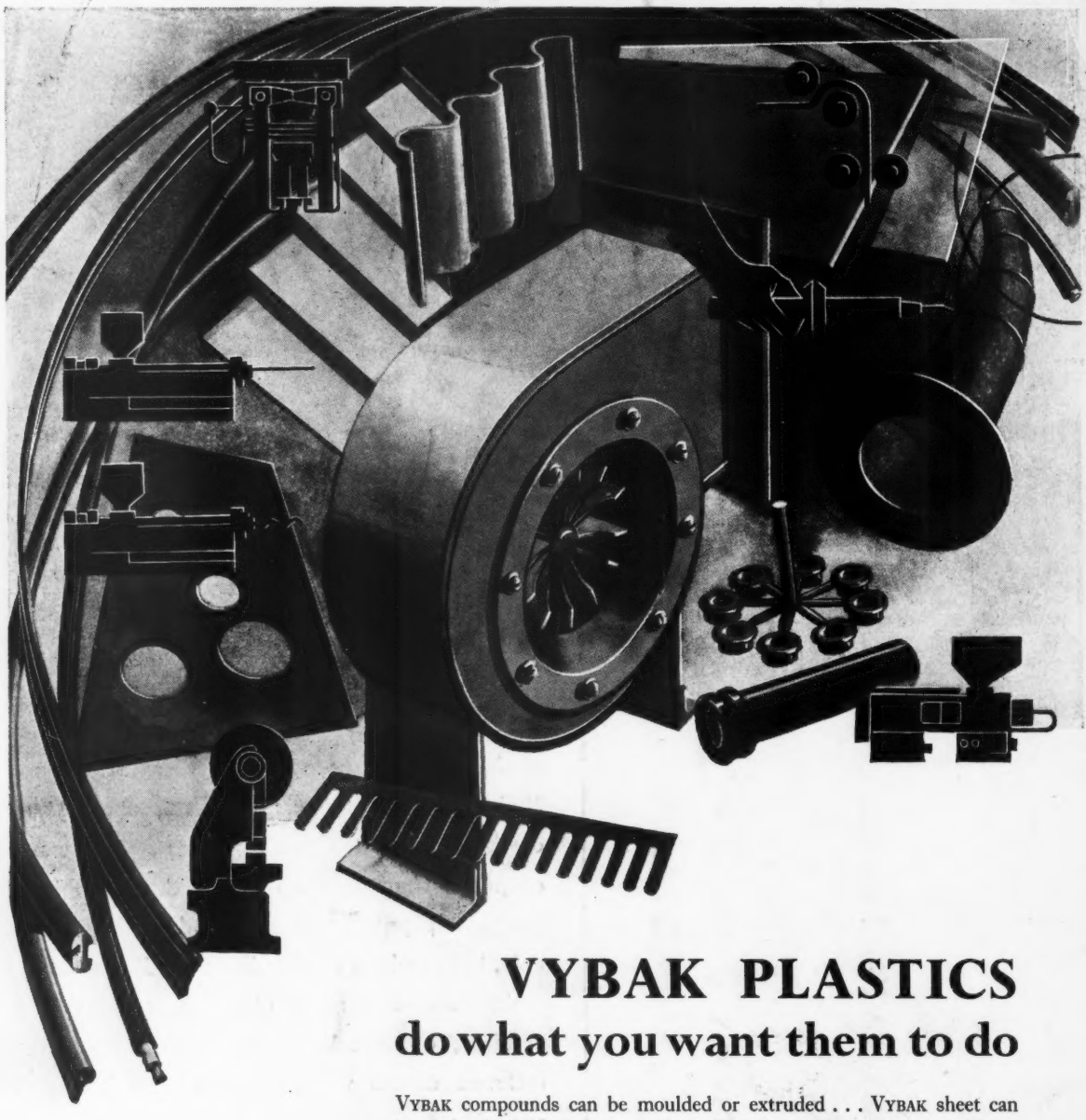
Blythe

COLOUR WORKS LTD

CRESSWELL · STOKE-ON-TRENT

THE HOME OF THE WORLD'S BEST COLOURS

Vol. XX. No. 212 Plastics MARCH, 1955



VYBAK PLASTICS
do what you want them to do

VYBAK compounds can be moulded or extruded . . . VYBAK sheet can be sheared, embossed or punched. Heavier grades may be machined, welded and formed. Do you want the product to be flexible—or stay rigid ; stretch—or remain dimensionally stable ? There is a grade of VYBAK to meet almost every need. For so many jobs, large and small, no sooner is a question asked than an answer is found in—

The main properties of VYBAK p.v.c. materials include strength, good electrical characteristics, and resistance to water, oil, chemicals, flexing and ageing. They are supplied as :

- *Moulding or extrusion compounds—rigid and flexible.*
- *Pressed or calendered sheet for machining or forming. Rigid and flexible.*
- *Vybak PVC-A copolymer resins.*

VYBAK
REG. TRADE MARK
Plastics

BAKELITE LIMITED

12-18 GROSVENOR GARDENS · LONDON · S.W.1 · TELEPHONE: SLOane 0898

98